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AUGUST 5, 1960

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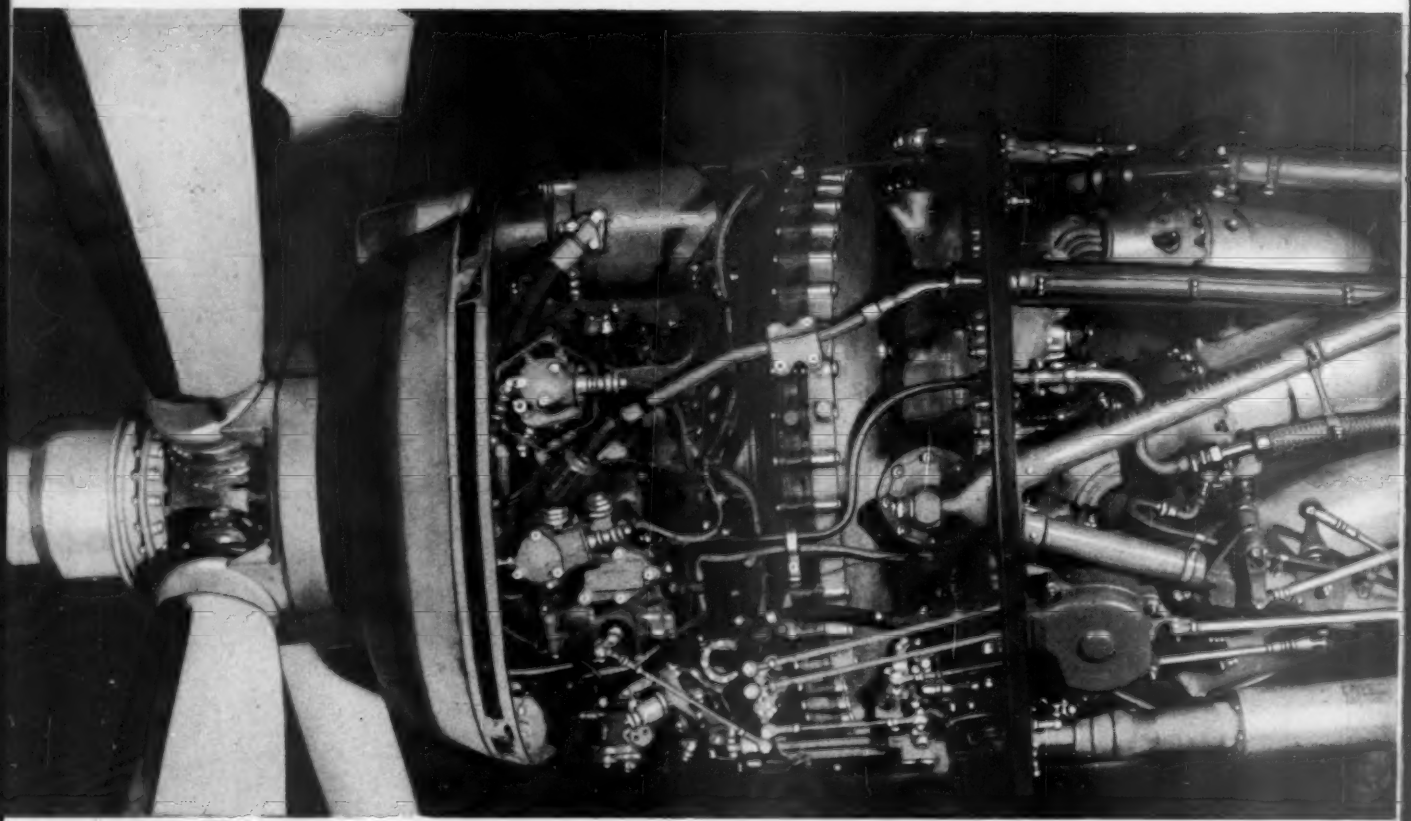

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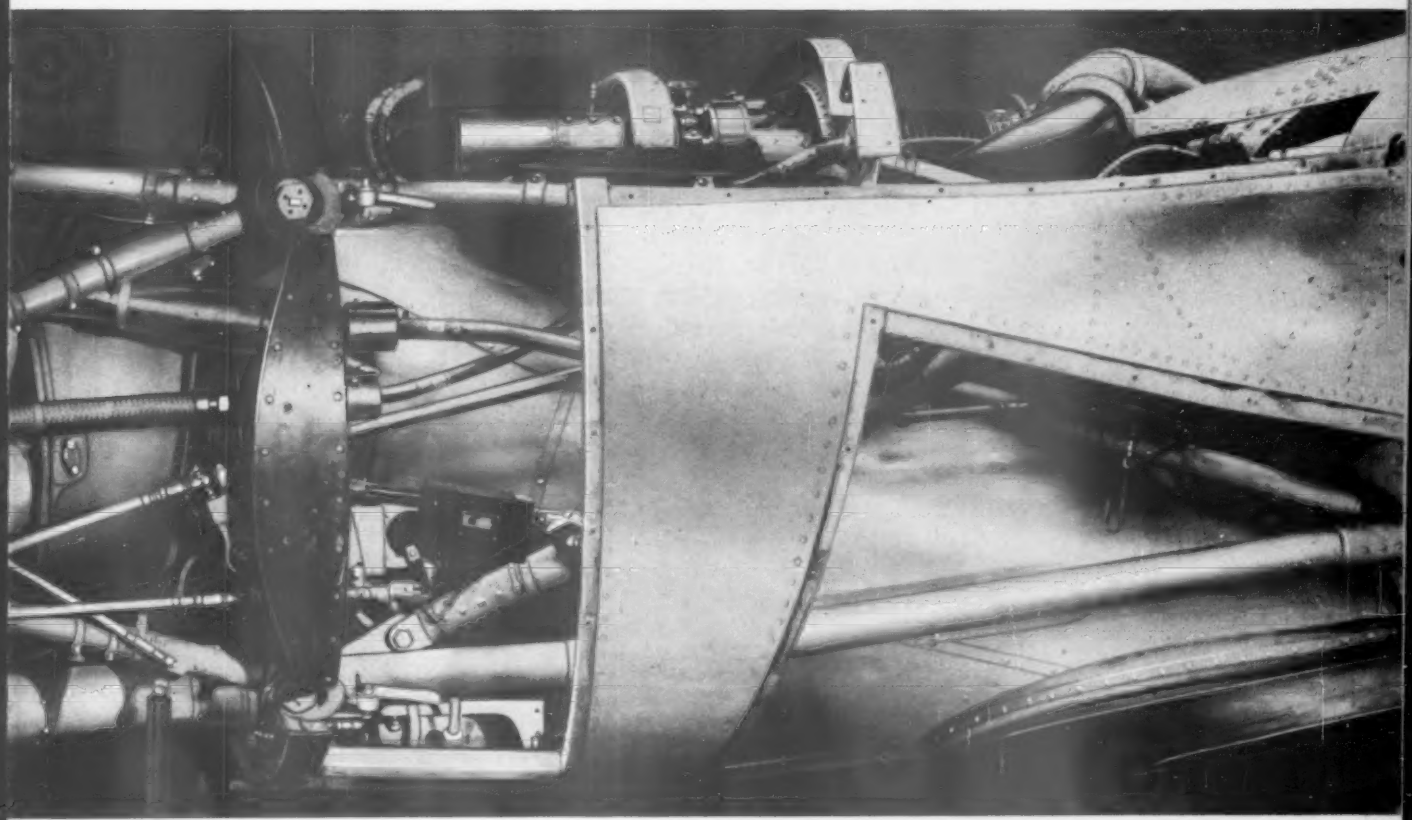

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THE AEROPLANE and ASTRONAUTICS

VOLUME 99 NUMBER 2546 AUGUST 5, 1960

Continuing Problems

Ministers come and ministers go but those who spend their lives in the British aviation business notice that its problems appear to go on for ever. Mr. Sandys, it was widely and rightly believed at the time, was brought in to merge the units of the aircraft industry into fewer but more broadly based agglomerations. This he brought about before he passed on to the complex problems of Commonwealth relations. He also tackled the disputatious relationship between the Corporations and the Independent operators. He has chosen a chairman for, and announced the membership of, the new air licensing authority. He wielded the axe that put " finis " to the attempt to provide the United Kingdom with her own rocket-borne deterrent. But his successor finds himself faced with the decisions to be made over the supersonic aircraft.

How many years ago we began editorially to argue the case for the supersonic airliner is hard to recall. In the intervening period, lack of interest in a British undertaking, and in certain quarters outright hostility, have vanished. Both big groupings have put forward their proposals. Before Mr. Sandys moved on to higher things he had made it plain that, though his Ministry could not yet commit the country to the many millions of expenditure involved in such a development, they were ready to take the next step. This would take the form of a contract given to one of the two contending groups (and B.A.C. are the favourites) and to one engine firm for a design study. Sir Gerard d'Erlanger in his retiring speech made it clear that B.O.A.C. as an airline operator is planning on the assumption that it would be necessary to operate supersonic airliners in ten years. The new chairman, Sir Matthew Slattery, is known to be just as forward looking.

It is also to be noted that Sir Gerard raised a matter also of much concern to the new Minister, namely the inadequacy of London Airport. He warned that by the time the new long-distance terminal is completed, London Airport may still be inadequate to deal with the number of people moving through it. A paradox of London Airport is that present enjoyment of all the state-paid splendour is the prerogative of domestic passengers; foreign visitors and friends from overseas arrive at, and are cleared through, buildings which recall the shelters of a displaced persons camp. But buildings apart, and besides the problems of adequate space, an equally pressing question that will never be solved until a Minister of Aviation gets into close co-operation with his colleague the Minister of Transport, is the matter of surface transport. Neither buses nor helicopters are the solution. Some form of vehicle using a special track is certainly the only answer. The daily average throughput of passengers at London Airport is such that there are no helicopters in sight big enough to handle more than a selected few of such numbers.

Famous Men

Last week obituary notices appeared of two men who played important parts in a vital period of British aeronautical endeavour between the Wars. It was the clear vision of men like Wimperis and the practical application of men like Raymund Hart which made it certain this country had the right weapons with which to win its vital air battles. And if the curtain of security on occasion obscures erroneous decisions there is the more cause for being thankful for those who, unknown to their countrymen at the time, were making the right decisions behind the same curtain.

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Matters of Moment

The New Aviation Minister

OF the Rt. Hon. (George Edward) Peter Thorneycroft, P.C., Conservative member for Monmouth since 1945, who has just been appointed Minister of Aviation, "Who's Who" records as follows:—

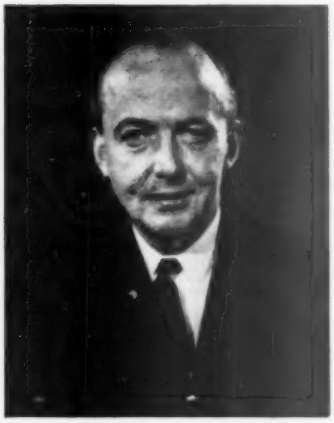
Born July 26, 1909. Educated Eton; Royal Military Academy, Woolwich. Commissioned in Royal Artillery, 1930; resigned Commission, 1933; called to Bar, Inner Temple, 1935; practised Birmingham (Oxford Circuit); M.P. (C.) Stafford 1938-45; Parliamentary Secretary, Ministry of War Transport, 1945. President of the Board of Trade, Oct. 1951-Jan. 1957; Chancellor of the Exchequer, Jan. 1957-Jan. 1958, resigned. Chairman: Pirelli, Ltd.; A.E.G. Unit Trust (Managers), Ltd.; Commonwealth Unit Trust Fund (Managers), Ltd.

Mr. Thorneycroft resigned, it will be recalled, as Chancellor of the Exchequer in January, 1958, because of his belief that government expenditure must be kept within bounds, and his proposals for doing so were not acceptable at that time. He must therefore be expected to keep a tight hold on expenditure and the Premier's selection of Mr. Thorneycroft to look after Aviation is in keeping with the declaration of Mr. Amory, the outgoing Chancellor, that Government capital investment this year was to be kept at last year's level.

As President of the Board of Trade he had to carry through a tough policy in rationalizing the cotton industry in Lancashire and in that traditionally tough-speaking shire he was inevitably called some hard names.

The new Minister takes over at a time when the general attitude of mind in the Conservative Party is that economies must be made and taxes cut. Politically, it has to be noted that Tory Right Wingers want economies and will praise all who make them.

Against these pressures it is quite clear that decisions to economize British aviation out of the supersonic airliner business and out of the development of space vehicles will prevent the energizing of new technological skills and their ultimate commercial exploitation. In these circumstances a new Minister seeking economies may well find that considerable savings could be achieved by cutting down the administrative and technical organizations that his Ministry controls. In any case the smaller the Government stake in aviation, the fewer the numbers if civil servants required to supervise the programmes.



Mr. Peter Thorneycroft who becomes the Minister of Aviation to succeed Mr. Duncan Sandys.

An Air-minded War Minister

APPOINTMENT of Mr. J. D. Profumo to be Minister of War at the early age of 45 will be warmly welcomed by his many friends in aviation. It will be recalled that he became Parliamentary Secretary to the Ministry of Civil Aviation in November, 1952, following Mr. Maudling in that post. Later, when M.C.A. became M.T.C.A., Mr. Profumo became Joint Parliamentary Secretary, becoming Parliamentary Under-Secretary of State for the Colonies in January, 1957.

While at M.T.C.A. he was industrious in looking after aeronautical affairs and in particular private flying of which, as a pre-war member of the Leamington, Warwick and District Aero Club, he had practical experience. In these days and in the foreseeable future when the Army is having to turn more and more to the air for mobility and tactical manœuvre, the appointment of a Minister with practical experience of air affairs is particularly welcome.

No one who has studied the situation can be satisfied with the amount of air equipment available to the Army. Mr. Profumo, it is clear, has plenty to busy himself with.

The Worst Helicopter Accident

A 10-YEAR record was broken on Jly. 27 when 11 passengers were killed in an accident to a Chicago Helicopter Airways' Sikorsky S-58. The accident, which occurred on an 18-mile flight between the two Chicago airports, O'Hare and Midway, was the first involving passenger fatalities on scheduled helicopter operation, and the worst helicopter accident on record. Regular passenger services began on Jne. 1, 1950, by B.E.A., whose Helicopter Experimental Unit flew various trial services from then until 1956.

The major U.S. helicopter airlines are now New York Airways (since July, 1953) and Los Angeles Airways (since November, 1954). Other helicopter operators have begun scheduled service more recently, including several in Europe, and for the past year Aeroflot has been rapidly expanding this class of service in Russia. Sabena was among the pioneers.

Chicago Helicopter Airways began operation in November, 1956, primarily to fly between the two airports, and these services have developed rapidly over the past four years. The company now operates 137 flights a day serving downtown Chicago and the two suburbs of Gary and Winnetka in addition to the airport. Its fleet comprises eight S-58s and five Bell 47s, with three turbine-engined S-61s on order.

The circumstances of the accident are not yet clear, but it seems that the helicopter was out of control before it crashed. Several eye-witnesses reported a fire or explosion in the air; the wreckage burned fiercely on the ground.

ANGLO-FRENCH AMITY.—Units from No. 72 Squadron R.A.F. and the *30e Escadre de Chasse Tous-Temps* have recently been on exchange visits (see THE AEROPLANE AND ASTRONAUTICS, Jly. 29) at Leconfield and Tours. Here a Vautour from the French squadron poses with a Javelin from No. 72 Squadron.

Photograph copyright "The Aeroplane and Astronautics"

Exports Remain High

SALES abroad by the British aircraft industry during the first half of 1960 were worth £76,494,146, giving an annual export rate of £153 million. During these six months, the aero-engine contribution amounted to £38,098,952, equivalent to an annual rate of £76 million. This compares with last year's record aero-engine export figure of £64½ million. Aero-engine sales have been going from strength to strength. After setting a record quarterly figure of £17½ million during the first three months of the year, sales for the second quarter rose to more than £20 million.

The half-yearly total, £76,494,146, was made up as follows: aircraft and parts, £34,839,294 (aircraft, £21,733,210, and parts, £13,106,084); aero-engines, £38,098,952 (505 "new" valued at £16,730,944 and 628 "other than new," £10,481,076; and parts, £10,886,932); electrical parts and appliances, £1,767,139; tyres, £672,686; and aeronautical instruments, £1,316,075.

Leading buyers of aircraft, in order of expenditure, were India, Switzerland, Argentina, the United States, Egypt and New Zealand. Leading buyers of aero-engines were the United States, France, Canada, India, Italy and West Germany.

Aviation in Parliament

SPACE research, customs facilities for private aircraft, the contract for the Britannic, and the membership of the Air Licensing Board have been the main matters before Parliament during the week under review.

Supersonic airliner. The Government have examined the reports made by the principal airframe and aero-engine groups on the feasibility of developing a supersonic airliner. The Government are ready now to consider proceeding further. This next stage will involve selecting one of the two airframe groups and one of the two aero-engine groups to pursue the work of detailed design. The Ministry is discussing with the four companies concerned the financial and other terms on which the project might be undertaken.

Space research. The results of the Government's studies of the scientific, technological, commercial and other benefits, together with the cost in money and resources, are being communicated to the Australian Government with a view to discussing with them fully all aspects of the problem. A Minister is to visit Canberra for this purpose. This information was given by Mr. Sandys to MR. CHETWYND (Lab. Stockton).

Private aircraft, Customs.—Facilities are available at Southend airport for Customs clearance of private aircraft owners not in possession of radio, subject to prior permission of the airport authority. Mr. Sandys told MR. GOUGH (C., Horsham). In the summer months, facilities are also available until 20.00 hrs. at Shoreham by prior permission. The Standing Joint Committee on Private and Club Flying is considering "this difficult problem."

Britannic.—Mr. Sandys expects that the contract for the Britannic will be placed soon, he told MR. STRAUSS. An interim contract has been placed to obviate any delay.

Improved FIDO. In the House of Lords, Earl Bathurst, Lord in Waiting, said that experiments and trials with an improved FIDO device had been carried out and it was now known that it was guaranteed to clear intense fog effectively on an aerodrome. Before deciding to instal FIDO or some other system at London Airport the M.o.A. wanted some assurance that the airline would pay a share of the cost, which would be in the region of £700,000 for installation and £280 for a landing and £70 for a take-off.

Hovercraft Expansions

A GROWING interest in air-cushion craft of the Hovercraft type was in evidence last week with the official announcement of two newcomers to this particular field of design and construction. The Hawker Siddeley Group and William Denny and Bros. Ltd., of Dumbarton are to collaborate with Hovercraft Development Ltd. in this sort of work.

No information has been released by the Hawker Siddeley Group concerning its air-cushion project. It has, however, been reported that the necessary design and manufacturing work will be done by Folland Aircraft at Hamble.

The William Denny project is a "side-wall river craft." According to H.D.L., "this is a type of Hovercraft with side walls which are partially immersed in the water and the cushion of air under the craft is retained by these side-walls and a curtain of air at the front and back. The advantage of the side-wall craft is that it requires less power to produce the air cushion. It is in effect an 'air-lubricated ship'."

These two newcomers bring the total to four British companies involved in this field. These are: Westland Aircraft (Saunders-Roe division) and Vickers-Armstrongs (South Marston) Ltd.—who have already announced plans for joint programmes with H.D.L.—Hawker Siddeley and William Denny.

MAIDEN FLIGHT.—The "development prototype" of the Armstrong Whitworth 660 military transport seen during its first flight on Jly. 28. More details on page 151.

Inter-Services Gliding Championships

FOR the first time held independently of the National Gliding Championships, the Inter-Services Gliding Championships finished at Odiham on Jly. 30. The opening of the contest is reported on p. 158. The Inter-Services gliding champion, who was awarded a magnificent trophy, presented by Mr. Jack Emmett, was Capt. Edward Shephard of the Army Air Corps, who scored 273 points out of a possible 400. Runner-up was Ft. Lt. D. Cretney with 269 points. The Inter-Service team championship went to the R.A.F. team led by Gp. Capt. N. W. Kearon whose team mates, Flt. Lt. D. Cretney and Sgt. J. Williamson, scored a total of 709½ points. The Army led by Maj. Sir Charles Dorman came second with 519 points and the Navy, led by Cdr. Antony Goodhart, were third with 121 points.

Mr. David Ince who has the distinction of having been a Lieut. in the Army and a Flt. Lt. in the Air Force and who, with Mr. Wally Kahn, had been invited as task setter to fly *hors concours*, gained 301 points.

The Air Secretary, Air Chief Marshal Sir Theodore McEvoy, at the prize-giving ceremony spoke of the tremendous success of the contest and looked forward to future competitions between the three Services.

Although the championships were marred by extremely unfavourable weather, the high standard achieved by the various pilots does great credit to the three Services' Gliding Associations. Two outstanding flights, made after the end of the contest, were by Warrant Officer E. Stark of the Army who flew from Odiham to Sunderland (260 miles) on Jly. 31 and on Aug. 1, Corporal J. Ramsden of the R.A.F. Leeming Club climbed to 22,500 ft.

National Gliding Week—Leading Scores

London Gliding Club, Dunstable

	Pilots	Sailplanes	Points
1.	Peter Scott	Olympia 419	489.6
2.	G. E. Burton	Skylark 3B	445.4
3.	D. M. Kaye	Eagle	438.6
4.	D. A. Smith	Skylark 3	421.6
5.	R. A. Mann	Skylark 3	421.1
6.	C. A. P. Ellis	Skylark 3	404.0
7.	C. W. Bentson	Skylark 3F	395.2
8.	G. H. Stephenson (22 entrants)	Skylark 3F	330.1

Coventry Gliding Club, Edgehill

1.	L. Redshaw	Skylark 3F	371.0
2.	B. J. Davey	Skylark 3F	327.0
3.	D. C. Snodgrass	Skylark 3B	283.0
4.	R. J. Tarver	Olympia 2	239.0
5.	A. H. Baynes and K. W. Blake (13 entrants)	Skylark 3B	230.0

Yorkshire Gliding Club, Sutton Bank

1.	J. T. Griffiths and R. S. Waller (Cambridge Un. Gliding Club)	Swallow	600.0
2.	R. A. Hallewell and H. Doktor (Yorkshire Gliding Club) (4 entrants)	Swallow	87.4

Matters of Moment . . . .

A Soviet Rocket Transport?

FUTURE use of Soviet rocket space-vehicles for high-speed intercontinental travel has been forecast by Prof. Georgi Pokrovsky. In an interview published in *Soviet Weekly*, he stresses that the target area in the recent Pacific rocket tests was less than half that previously reserved for Soviet rocket firings; this shows "the substantial progress of Soviet rocketry." No less important, he says, is that the 8,077-mile range test-rocket was fired, and arrived in the target area, at precisely the time scheduled.

Coupled with the recent experiments in which two dogs and a rabbit were lifted into space to come safely back to Earth, said Prof. Pokrovsky, the rocket tests seem to indicate that the Soviet Union is quickly approaching the point where rockets can be used not only for space travel but for intercontinental manned flights as well.

A rocket trip from, say, Riga on the Baltic to Santiago in Chile, or from the U.S.S.R. to Antarctica, would take only 45 to 50 minutes, he said. To travel that distance, Prof. Ari Sternfeld had calculated that the multi-stage rocket should be launched at an angle of 15° 48′ with a minimum cut-off speed of 24,662 ft./sec.

A Sopwith Apprentice Retires

FROM London Transport recently came news of the retirement of its Equipment Engineer (Road Services), Mr. J. H. Williams, A.M.I.Mech.E., A.M.Inst.T., after 40 years of service starting with the London General Omnibus Company. Although Mr. Williams has spent a working lifetime as a surface transport engineer, he began as an articled apprentice to the Sopwith Aviation Company at Kingston-upon-Thames in 1915. Later he was commissioned in the Royal Air Force and returned to Sopwith in 1919 to complete his apprenticeship.

During his time with the Sopwith company Mr. Williams was associated with the development of such renowned aircraft as the Pup, 1½-strutter, Triplane, Camel and Snipe. It seems, however, that he was rather more interested in their powerplants and he had much to do with such early engine installations as the Gnôme and le Rhône, Clerget and Hispano-Suiza. He can recall the Sopwith Tabloid seaplane being taken down to Turk's boathouse and flown from the river. And he remembers flying from Brooklands with the late Harry Hawker, the Sopwith chief test pilot.

When he left Sopwith to go into the motor transport business he continued his association with powerplant engineering—for his first work with the London Omnibus Co. was in the experimental department investigating carburation and fuels.

Lord Iliffe

WE much regret to record the death of a distinguished Past Master of the Guild of Coach Makers and Coach Harness Makers (1936), Lord Iliffe of Yattendon, who was created 1st Baron in 1933. He died in London on Jly. 25, aged 83.

Lord Iliffe entered the national newspaper field in association with the Berry family in the 1920s and from 1928 to 1937 he was part-proprietor of the *Daily Telegraph*. He also held the deputy chairmanships of Allied Newspapers, Amalgamated Press (now Fleetway Publications) and controlled Kelly's Directories which had acquired all the Iliffe periodicals, one of which our contemporary *Flight* had become in 1934. When he disposed of these interests, he acquired the *Birmingham Post and Mail* for £2¼ million in 1942.

Lord Iliffe was Honorary Air Commodore No. 916/7 (Co. of Warwick) Balloon Squadron, R.A.F., from 1939 until 1944.

Mr. Richard Fairey

NEWS of the sudden death of Mr. Richard Fairey, eldest son of the late Sir Richard Fairey, in Cannes on Jly. 27 was a grievious shock to the many friends of the family in aviation Although he had had to give up his vice-chairmanship of the Fairey Company last June on medical advice, he was so vigorously cheerful that a full life still seemed before him.

An account of Richard Fairey's career, he was born in 1916, appeared in our issue of Jne. 10 last.

He had flown as a pilot before the War and it was this experience which qualified him as a member of Air Transport Auxiliary in which he became a First Officer. In those early days those who went to help the Atlantic Ferry Organization had to make the crossing by sea and it was when his ship was torpedoed that Mr. Fairey suffered the frost-bite which led to the amputation of both legs.

It was a measure of his determination that so handicapped, he flew solo in a helicopter after only 105 minutes of dual instruction. He soon afterwards became one of the first operators of an executive helicopter.

Sir Richard Fairey's estate was aggregated at just over £1 million. Estate duty liability of £741,300 and other priority interests reduced the residue to a comparatively small sum and it was of this that Richard Fairey took his third share.

ARMY SHOW.—On Jly. 23 the Army Air Corps gave a successful first public air display. Among the items were: left, the M.L. inflatable aircraft; below left, the Alouette helicopter; and below, a veteran Bristol Fighter. A Wren drawing is on page 158.

Aviation News in General

U.S. FLYING BAN.—All civil flying over the U.S. and Canada will be banned for a six-hour period on Sept. 10, for a major defence exercise by the North American Air Defense Command. Exercise "Sky Shield" will take place between 01.00 and 07.00 hrs. and will test the whole system of radar networks, headquarters organization, communications and counter-measures.

DEVELOPMENT A.W.660. — On Jly. 28 the "development prototype" of the Armstrong Whitworth 660 military transport made its first flight. This aircraft is one of the original batch of 10 civil Argosies; it has been modified to the same aerodynamic shape as the A.W.660 and has its "beavertail" rear-loading and freight-dropping door. The aircraft will presumably be seen at the Farnborough S.B.A.C. Show in September.

LIGHTNINGS ARRIVE. — No. 74 Squadron, which is the first operational Fighter Command unit to equip with the English Electric Lightning, has now received its first aircraft at Coltishall, Norfolk. Firestreak-armed Lightnings have completed an extensive programme of weapons systems testing at the Central Fighter Establishment, and operational training is soon to begin at squadron level.

R.A.A.F. ORDERS.—The Australian Government has ordered 11 helicopters from the United States. They will be used to equip a new R.A.A.F. squadron designed for Army support work.

TARGET FLIGHTS.—Radio controlled Meteors operated by Short Bros. and Harland, Ltd., have successfully completed 100 pilotless sorties. They fly from Llanbedr in North Wales and act as target aircraft for missiles fired from Aberporth.

RB-47 IN U.N.—The Security Council debate on the U.S.A.F. RB-47 shot down by Russia on Jly. 1 ended with Russia vetoing proposals that the incident should be investigated and that the International Red Cross should make contact with the survivors. The U.S. stated that "the evidence of our scientific devices" showed that the aircraft had been forced by a Soviet fighter to within 30 miles of the Russian coast, compared with the 50 miles planned, but that it had gone no closer. British "technical devices" also confirmed the U.S. evidence.

RECORDS CONFIRMED. — The F.A.I. has confirmed as World Records the speed of 1,525.934 m.p.h. by Maj. J. W. Rogers in an F-106A and the speed over 100 km. closed circuit of 1,167.38 m.p.h. by Brig. Gen. J. H. Moore in an F-105B, both set up last December. Russia has since claimed to have exceeded the latter record. Confirmed as class records are the climb to 30,000 m. (98,425 ft.) in 15 min. 4.92 sec. by Capt. J. B. Jordan in an F-104C; the speed of 596.47 m.p.h. with a 15-tonne payload over a 2,000 km. closed circuit by a Tu-104E (20,950 lb.s.t. RD-3M turbojets) and the following speeds over distances by the Tu-114 (12,000 h.p. TB-12 turboprops) with a 25-tonne payload: 541.45 m.p.h. over 1,000 km.; 532.69 m.p.h over 2,000 km. and 545.07 m.p.h. over 5,000 km.

DECCA RELIABILITY.—The Decca Navigator Co. tells us that the reliability figures given for Decca Mk. 10 equipment in Mr. S. M. B. Lane's article in our issue for Jly. 15 presented too pessimistic an impression. The final reliability achieved in the trials mentioned was, in fact, 91.04%; moreover, this was achieved with prototype equipment and on a single installation only.

NEW CESSNA.—What the Cessna company calls a "light light-twin of completely different design" for executive use is being built in prototype form and is scheduled to make its initial flight early next year. A four-seater, the new type is said to represent "a basic new approach to twin-engine philosophy and a new pattern of thinking and engineering." It is expected to be on the commercial market by 1962.

VISCOUNTS TO GUERNSEY.—B.E.A. are to introduce Viscounts on its services to Guernsey on Aug. 1. Payload will be restricted to 55 passengers and baggage until later in the month, when the runway extension will be opened, to give a length of 4,800 ft.

NEXT WEEK

THE AEROPLANE AND ASTRONAUTICS for Aug. 12 will contain special astronautical features. These will include comprehensive charts and scale drawings of satellites, space-probes and boosters. There will also be full details of the R.A.E.'s design studies to adapt Blue Streak and Black Knight as Britain's first satellite launcher, and industry plans to produce a communications satellite.

ALL-WEATHER HELICOPTER.—The F.A.A. have approved and certificated the Cessna CH-1C helicopter for flight under Instrument Meteorological Conditions. Previously certificated for VFR operation, it is the first American civil helicopter to obtain this classification.

NEW OPERATOR.—Mercury Airlines was registered last week in Jersey. Its founders include Lord Calthorpe, previously associated with Overseas Airways. Purpose of the company was stated to be to provide air transport and act as carriers of freight and passengers to and from the Channel Islands.

COMET DELIVERED.—The sixth and last Aerolineas Argentinas Comet was delivered at Hatfield on Jly. 25. From August, 1959, to the spring of this year A.A. Comets have been achieving more than 9 hr. a day utilization and maintenance man-hours to flying hours have been in the ratio of 1 : 5.

BREGUET VISIT. — The Breguet Br. 942 is among the STOL transports at present being evaluated by B.E.A. Mr. Peter W. Brooks and Mr. R. H. Whitby recently visited the Breguet works to study this project.

AG-CATS GO.—First deliveries of production Grumman Ag-Cats were recently made to Uruguay and Puerto Rico, for agricultural operations in those countries. To reach Uruguay, it was necessary for the open-cockpit single-seat biplane to cross the Andes, and the total ferry trip was nearly 9,000 miles. The other Ag-Cat was air-delivered over a 2,468-mile route, after its construction by Schweitzer Aircraft, subcontractors for Grumman.

PORTSMOUTH STAYS OPEN.—Proposals that Portsmouth's grass aerodrome should be closed have been rejected by the Corporation's airport committee, after more than a year of discussion. A plea for a Government grant towards the cost of a modernization scheme including runways has been rejected.

SPADEADAM COSTS.—Cost of constructing an M.o.S. "research establishment in Cumberland" rose from an estimated £10 million in 1956 to a current estimate of £25 million, according to the Second Report from the Committee of Public Accounts. This establishment is probably Spadeadam, built for Blue Streak rocket-motor testing.

SPACE RESEARCH GRANTS.—First 16 grants for satellite and rocket instrumentation to British universities have been decided by the British National Committee on Space Research. The total money involved is £184,540. Of this, the largest sum (£44,330) goes to Dr. Robert Boyd, University College, London, for a three-year programme to examine "upper air temperature and density, radiation from the Sun and stars, and the development of photo-electric satellite-tracking equipment."

SUPER POLARIS.—The U.S. Navy has announced plans to produce a super Polaris missile by 1964. It will have a range of 2,500 miles.

NASA PROGRAMME.—Over the next 10 years, NASA expects to conduct 260 space experiments, including a test-firing of a nuclear-powered rocket in 1965. Plans for manned space flight remain as follows: short-range, sub-orbital, flight this year; orbital flight next year; unmanned spaceship around the Moon and back in 1963-64; man on the Moon "after 1970."

B.A.C. APPOINTMENTS.—Mr. G. R. Bryce is to become chief test pilot of the British Aircraft Corporation. Mr. R. P. Beamont will be the deputy chief test pilot and Mr. A. H. C. Greenwood is to co-ordinate aircraft sales and service.

"TEX" FOR DYNA-SOAR.—A. M. (Tex) Johnston, the former chief of flight test for Boeing, has been appointed an assistant Boeing programme manager for the Dyna-Soar manned space glider.

PIASECKI ENGINEER.—Mr. F. E. Mamrol has been appointed chief engineer of Piasecki Aircraft Corporation. He was formerly chief of design and chief project engineer of Piasecki Aircraft.

HEINEMANN RESIGNS. — Mr. Edward H. Heinemann, recently appointed to take charge of Douglas Aircraft's European Division, has resigned to take up a post with another company. He will continue his association with Douglas as a technical consultant.

Air Transport

The A.T.L.B. Appointments

QUIETLY, with no flourish of trumpets, the names of the members of the Air Transport Licensing Board were announced by Mr. Duncan Sandys in a written answer in the House of Commons on Jly. 26. Apart from that of Lord Terrington—whose appointment as permanent chairman has been confirmed (see our issue of Jly. 8, p. 33)—the seven names include only one with a background of air transport or aviation experience. The members are:—

Professor R. G. D. Allen, C.B.E., Professor of Statistics, London School of Economics; Mr. C. Bagnall, C.B.E., Managing Director, British Nylon Spinners, Ltd.; Mr. E. Baldry, O.B.E., senior partner in Messrs. Allen, Baldry, Holman and Best, chartered accountants; Sir Friston How, C.B., formerly secretary of the Atomic Energy Office; Mr. W. P. James, O.B.E., Chairman of the Traffic Commissioners, West Midland Traffic Area; and Mr. A. H. Wilson, C.B., C.B.E., formerly Deputy Secretary, M.T.C.A.

Maybe there is a justification for such a majority of members from the outside world—aviation normally tends to be a closed group and the thinking and behaviour within this group can sometimes lead it along strange paths—but one cannot help wondering how the newcomers will react to the problems with which they will be faced. It can only be hoped that the "outside thinking" will offer a new approach to these problems and that a larger permanent secretariat will provide a hard core of air transport experience and be in a position to maintain adequate statistical and traffic researches.

Who Should Pay?

THE essential oddness of the way in which aviation is conducted is never more clearly shown than it is in the periodic reports from lay committees—the members of which see the whole thing through the eyes of ordinary persons. The opinions of the members of the Select Committee on Nationalized Industries, for instance, saw air transport in a refreshingly new way, and those who produced the Second Report from the Committee of Public Accounts have been equally astonished by some of the curiosities of the business.

In the section dealing with aerodrome accounts the committee is not only "disturbed" by the size of the deficits incurred, but seems to be mildly shocked by the fact that no specific charges are made for "technical services for approach, landing and take-off," and, in particular, by the arrangements made with the Manchester and Birmingham Corporations.

In the case of Manchester the Ministry had contributed about £1 million, up to Mar. 31, 1959, towards the cost of capital works and had provided technical services at a cost of about £183,000, yet no provision was made in the 1955 agreement for any return on capital expenditure, or for a share in any profit, or for the levying of a charge for technical services. Landing fees are regarded by the Ministry as a composite charge which covers both landing and technical services, yet the Corporation gets the landing fees; as traffic increases the Corporation thus enjoys additional revenue, but the Ministry just spends more on the technical services. Which is very normal and understandable to those in the aviation business—but odd to the eyes of the outsider. The Committee considers that the matter should be reviewed. The Birmingham agreement, incidentally, includes an arrangement whereby operational profits (if any) will be shared with the Ministry.

For the year 1958-59 there was a deficiency of £6,366,247 on the 26 aerodromes operated by the Ministry. The loss on the 15 aerodromes which are hoped, eventually, to be self-supporting was about £5.4m. London Airport lost £2,111,000, Prestwick lost £565,000 and Gatwick (in operation for its first 10 months) lost £918,000. Technical services accounted for about half the deficiency at both London and Prestwick.

Capital Plans a Merger

FIRST positive indication that Capital Airlines was seeking a merger as a way out of its present financial difficulties came last week, when a plan to merge with United Airlines was announced. The plan requires the approval of the shareholders of both companies, the C.A.B., and the Securities and Exchange Commission.

Vickers-Armstrongs, which is reported to approve the proposal, would be offered $15.9 million of United's preferred stock, 60,000 shares of common stock and an option to buy a further 200,000 common stock over the next 7½ years. The makers would also take back 15 Viscount 745s surplus to the requirements of the merged airline.

Under the merger plan, Capital would lose its identity and United Airlines would gain traffic rights at a number of additional points in the U.S. The attitude towards the plan of the Capital Shareholders' Association, representing several thousand employee-shareholders, is not known.

An Agreement on Noise

AS a back-up programme to its series of noise-reducing air traffic rules at major airports, the F.A.A. has issued standard procedures to be followed by turbine aircraft in the take-off and landing phases. The procedures have been worked out in joint consultation between the F.A.A., the airlines, pilots and aircraft and engine manufacturers, and will be voluntarily adopted for incorporation into pilot training manuals.

Covering, at present, the Boeing 707, Douglas DC-8, Convair 880, Lockheed Electra, Vickers Viscount, Fairchild F-27 and Eland-Convair 540, the procedures take the form of ten standard operating factors for take-off, straight climb-out, climbing turn, approach and landing. They will apply to the turbojet types at altitudes up to 2,000 ft. and to turboprop types up to 1,500 ft. Turns off the take-off path will be limited to a minimum 500-ft. altitude and 20-degree bank angle for all types. For jet aircraft, the minimum descent angle is 2.5 degrees and the terminal area manœuvring speed is restricted to 200 knots below 3,000 ft.

Pictorial Vortac

IF it has done nothing else, the pressure applied by the contestants in the Decca versus VOR/DME controversy has stimulated practical interest in pictorial presentations for navigational aids. At least four pictorial display devices for use with Vortac are being used in a procedural development programme conducted by the U.S. Federal Aviation Agency's National Aviation Facilities Experimental Center. One or two of these are redevelopments of display systems which were designed as much as a decade ago.

According to our contemporary, *Aviaton Week*, one or more of these displays, designed for use with Vortac inputs, will be available to operators before the end of this year at a cost per unit of approximately $2,500 (£900).

The F.A.A. programme is not intended to evaluate the form of the displays so much as to develop procedures for their use in off-airways and off-VOR-radial routeing and in terminal-area patterns. A summary of a report by the Agency on work with two types of display was given in our issue of Mar. 18 this year. The displays used at present by the F.A.A. include one developed by the F.A.A. itself and others by A.C.F. Electronics, I.T.T. Laboratories and Sperry; in addition, Bendix, Bosch Arma and Collins are planning to market similar displays.

MOSCOW SERVICE. — Passengers boarding an Mi-4 at the new helicopter station which has been opened at the Central Airfield in Moscow. The helicopters provide a regular service between the capital and Sheremetyevo Airport, making the flight in about 10 minutes.

The B.O.A.C. Report

THE essential facts about B.O.A.C.'s financial results for 1959-60 were given in last week's issue (p. 122) and these are supplemented on this page with detailed figures and with a breakdown of the year's traffic results. In short, the Corporation itself made a profit of more than £4 million—the largest in its history—before deducting interest on capital, but suffered a deficit, when interest had been charged and associated-company results included, of £833,795. B.O.A.C. made a small overall profit of £277,813 by comparison with a loss, in 1958-59, of £2,084,651.

Total interest payments from B.O.A.C. and B.O.A.C. Associated Companies amounted to about £4.5 million, so the activities can be considered to have been profitable; B.O.A.C.'s capital charges alone amounted to rather more than £4 million. The taxpayer has not lost anything, though there is an accumulated deficit of £13.25 million to be repaid, presumably, in due course and succeeding years' results may be spoiled by losses involved in the sales of propeller-driven aircraft. The 10 DC-7Cs alone stand at a book value of £5.9 million and it is doubtful if they could at present be sold for much more than a fifth of this figure.

However, the Corporation is out of the red for this year and may well continue to be so. Interest, therefore, lies in the possible progress towards viability of the associated companies. Of these, Kuwait Airways (loss to B.O.A.C. Associated Companies of £240,320) was made the responsibility of the Corporation at the express request of the British Government and the deficit should not logically be included.

Middle East Airlines has shown an immense improvement—as forecast by its chairman—on 1958-59 and returned an operating profit of £65,911 and B.O.A.C.'s share of the resultant profit was £17,020. On the other hand B.W.I.A., which is, at present, a wholly owned subsidiary, returned a net loss of £618,335 and will soon need to be re-equipped to meet competition in the area. Among the other associates—outline financial results for all the companies were given in last week's issue—Aden Airways, Gulf Aviation, and Malayan Airways also made useful profits.

A number of additional points were made by Sir Gerard d'Erlanger and others during the Press conference following the introduction of the report.

The Corporation did not consider it reasonable always to be paying a fixed rate of interest on Government-supplied capital—and certainly not when, in effect, more money had to be borrowed from the same source in order to pay this interest. In the past eight years, the total amount of interest paid has been £14.8 million, and it has been necessary to borrow £13.7 million from the Government to meet this commitment.

Propeller-driven aircraft, which would be difficult to sell other than at a loss, were doing a useful and remunerative job on long-range charters—mainly for North American customers—and were likely to continue to do so for several years.

B.W.I.A. had great prospective value—but not at the present price in terms of annual losses sustained. The airline was at present a subject for the findings of the Tymms Commission, the report of which should be out soon. It was hoped that local capital could be attracted for B.W.I.A. and other associated companies and the structure of the company would obviously change when the W.I. Federation came into being.

B.O.A.C. and Eagle had applied to the A.T.A.C. for scheduled North Atlantic all-cargo services. The applications were being opposed by British United Airways which already held a licence (granted to Airwork), but which had not operated after the initial period of chartered services six years ago. If the Corporation's application is granted converted DC-7Cs and/or Britannias will be used initially.

On the subject of supersonic transports it was considered that these aircraft were, according to present estimates, going to be more expensive to operate, that fare surcharges would be necessary and that the faster services might be operated, on a supplementary fare basis, in parallel with those of subsonic transports. Seat-mile costs 15% (M=2.2) to 50% (M=2.7) in excess of subsonic figures were suggested—with the possibility that there might possibly be a "cost-break-through" speed in the M=3-4 bracket.

The report itself is mildly gloomy about the prospects of being able to obtain a full 10-year utilization out of the later subsonic turbojets before these (the VC-10s) are overtaken by the supersonic transports.

FINANCIAL RESULTS IN BRIEF

	1959/60	1958/59
Corporation's Operations	£	£
Total revenue	70,483,130	57,887,584
Net expenditure (excluding interest on capital)	66,182,557	57,044,461
Profit	4,300,573	843,123
Interest on capital	4,022,760	2,927,774
Result after remuneration of capital	+277,813	−2,084,651
Associated Companies' Operations		
Loss	639,188	2,532,207
Interest on capital	472,420	562,562
Result after remuneration of capital	−1,111,608	−3,094,769
Overall deficit	833,795	5,179,420

Capital

At Mar. 31, 1960, the total borrowings of the Corporation amounted to £137,172,865 made up as follows:

	£
British Overseas Airways Stock	57,594,293
Exchequer Advances	71,914,286
Bank Loans	7,664,286
	137,172,865

These borrowings were utilized as follows:

Capital employed:	£ (1959/60)	Per cent. (1959/60)	Per cent. (1958/59)
On Corporation's current operations	88,276,201	64.35	60.1
In associated and subsidiary companies	12,362,869	9.01	9.5
Progress payments for future aircraft	23,283,751	16.98	20.6
	123,922,821	90.34	90.2
Accumulated deficit on past operations	13,250,044	9.66	9.8
	137,172,865	100.00	100.0

TRAFFIC RESULTS IN BRIEF

	1959/60	1958/59	Percentage change over 1958/59
Aircraft miles flown	46,060,478	39,760,122	+15.9
Aircraft hours flown	151,000	150,284	+ 0.5
Passengers carried	587,372	470,437	+24.9
Passenger miles flown	1,835,354,032	1,459,993,016	+25.7
Available seat miles	3,042,089,615	2,418,014,413	+25.8
Passenger load factor	60.3%	60.4%	
Load ton miles carried :—			
(a) passengers	181,533,257	144,687,479	+25.5
(b) excess baggage	2,354,282	2,056,175	+14.5
(c) freight	39,266,715	33,681,622	+16.6
(d) mail	22,551,400	20,802,235	+ 8.4
(e) Diplomatic bags	283,541	272,203	+ 4.2
Total (a to e)	245,989,195	201,499,714	+22.1
Available capacity ton miles	433,513,756	353,341,499	+22.7
Overall load factor	56.7%	57.0%	

These statistics relate to B.O.A.C.'s own operations on scheduled services only, including its share of traffic on the services operated under pooling arrangements.

Points from the Report

In the 1959-60 year, 17.6% of c.t.m.s were produced by piston-engined types, 58.2% by turboprop Britannias and 24.2% by turbojet Comets. Passenger traffic on scheduled services was made up of 31% first class, 48.6% tourist and 20.4% economy.

*

Traffic revenue per capacity ton-mile averaged 35.9d. over scheduled and other services. The break-even load factor was the lowest ever at 55%.

*

Cumulative staff reductions in B.O.A.C. engineering and maintenance departments since January, 1958, are 1,245 at London Airport and 96 at Treforest.

*

Average daily utilization of aircraft available for operation was 7.63 hr. (7.42 revenue hr.) in 1959-60, the highest for three years. Best year since records have been kept on the present basis was 1955-56, at 8 hr. a day.

*

Staff employed at Mar. 31, 1960, totalled 19,131. Output per employee was 24,847 c.t.m. per annum. Traffic revenue per employee was £3,720 per annum—the highest to date.

*

Operating cost per c.t.m. came down to 33.8d. and cost per aircraft-mile was 26s. 5d. during the year.

*

Gross revenue per load ton-mile on scheduled services was 64.3d. in 1959-60 compared with 65.0d. the year before.

*

Over 3,000 hr. experience was obtained during the year with Marconi AD.2300 Doppler equipment installed in a Britannia.

*

The cost of the A.R.B. investigation of the Boeing 707-436 and the associated flying programme amounted to approximately $500,000, for which B.O.A.C. is contractually liable. Boeing accelerated their development and manufacturing programme to introduce previously planned modifications on the 707-436, at their own cost.

British Civil Aviation Prospects

—with Particular Reference to B.O.A.C.

THE appointment of Sir Matthew Slattery as the new full-time chairman of B.O.A.C., the setting-up of the new Air Transport Licensing Board, together with the recent Government-inspired rationalization of the aircraft manufacturing industry and of the private segment of the airline industry, mark 1960 as a turning point in the development of British air transport.

These developments are very largely the result of public disquiet about the progress of the British airline industry in the mid-, and later, 1950s. The past few years have, indeed, been a period of reappraisal of the whole of the United Kingdom's civil aviation effort since the War and some of the conclusions which have emerged have been sufficiently disturbing to force the Government to take action.

Britain's position in the World as a civil air power is dependent on progress in seven closely related fields:—

(1) Long-haul air transport: primarily in the hands of B.O.A.C.—our state-owned inter-continental "flag" airline.

(2) Short-haul air transport: primarily in the hands of B.E.A.—our corresponding state-owned operator in Europe.

(3) The privately owned segment of the United Kingdom's airline industry.

(4) The manufacture of transport aircraft: this has been primarily in the hands of six private companies during the period 1945-60.

(5) General aviation: all civil flying outside the field of air transport.

(6) The manufacture of civil aircraft other than airliners: this covers a wide range of types from those for executive, business, agriculture and other aerial work to private light aeroplanes and helicopters.

(7) Aviation ground facilities: airports and other civil aerodromes, air traffic control, navigational aids and all the other associated services.

Review of progress in these seven fields during the past 15 years has shown that:—

(1) B.O.A.C., which first made a profit in 1951-52, has since fallen back into a state of unprofitability and has latterly been losing ground, in terms of the proportion of World air traffic carried, primarily because of equipment difficulties and probably also because of deficiencies in its organization.

(2) B.E.A. has made good progress and has succeeded in establishing and maintaining itself as a profitable airline since 1954-55. The British share of the traffic within its area of operation has increased steadily enough although, latterly, the private operators have been taking an increasing share of the British portion of this traffic.

(3) The independent operators have made good progress during the latter part of the period. They have doubled their share of the British traffic during the past seven years and now carry 25% of the total. At the same time, shipping companies have acquired financial interests in the majority of them. However, many people are of the opinion that the private airlines could make an even larger contribution towards increasing Britain's share of World air trade.

(4) Some successes have been achieved in the field of transport aircraft manufacture—notably the Viscount—but there have also been many setbacks, particularly in the earlier years. As a result of an investment by the Government of something like £80 million on civil aircraft and engines during the past 15 years, a position had been reached by 1960 where, of 1,607 turbine transports in scheduled service or on order by the World's airlines, 682 (42%) were British and 1,022 (64%) had British engines.

(5) Quite extraordinarily little progress has been made with general aviation in the United Kingdom. Compared with the United States, which had 65,300 aircraft employed in general aviation in 1958 (doing three times as much flying as the airlines), Britain had only 890, doing a fraction only of the flying done by the airlines.

(6) Manufacture of the smaller types of civil aircraft in Britain has declined drastically in sympathy with the eclipse of British general aviation. In a field in which the U.K. was pre-eminent before the War, we are now nearly out of the running.

(7) Extravagant expenditure of the taxpayers' money is being incurred in providing ground facilities primarily for the two Corporations, the major independents and foreign airlines serving this country. In spite of this, there is a widespread feeling that we are not getting value for money, nor will do so as long as the airports continue to be run by the Civil Service. As an extreme example of present deficiencies, Britain's most-important long-haul terminal in the early 1960s still consists of a collection of grossly overcrowded temporary hutments on the northern edge of London Airport. In the same way, very little is being done to provide new, or make available existing, facilities for other air users. It would appear that the best solution would be to put the operation of all major airports into the hands of a commercially responsible National Airport Authority and, at the same time, take steps to encourage the use of all ground facilities by every type of air user.

(*Continued on page 155*)

Photograph copyright "The Aeroplane and Astronautics"

Rear Admiral Sir Matthew S. Slattery, K.B.E., C.B., D.Sc., F.R Ae.S., R.N. (Retd.)

44

AIRLINES HAVE CHOSEN . . . VISCOUNT

All Nippon Airways of Tokyo — three Viscount 810's ordered! Ghana Airways—three also! This now makes forty-four airlines with Viscounts in service or on order, as listed opposite. Five Governments and seven private companies or individuals also operate Viscounts.

22

HAVE RE-ORDERED . . . VISCOUNT

Of these forty-four airlines, twenty-two have now placed repeat orders for Viscounts.

2,500,000

HOURS HAVE BEEN FLOWN BY . . . VISCOUNT

This impressive total includes half a million revenue hours flown by BEA up to April 1960.

EUROPE
British European Airways
Air France
Aer Lingus
K.L.M.
Lufthansa
Alitalia
Austrian Airlines
Turkish Airlines
Airwork
Hunting Clan Air Transport
Tradair
Transair
Eagle Aviation
Icelandair

NORTH AMERICA
Capital Airlines
Continental Airlines
Northeast Airlines
Trans-Canada Air Lines
Maritime Central Airways

CENTRAL AND SOUTH AMERICA AND CARIBBEAN
Vasp (Brazil)
Pluna (Uruguay)
L.A.V. (Venezuela)
Lloyd Aereo Colombiano
TACA (El Salvador)
British West Indian Airways
Cubana

MIDDLE EAST
Middle East Airlines
Misrair (Egypt)
Iraqi Airways
Iranian Airways
Kuwait Airways

AFRICA
Central African Airways
Sudan Airways
South African Airways
Ghana Airways

SOUTH EAST ASIA
Indian Airlines Corporation
Pakistan International Air Lines
Union of Burma Airways
Malayan Airways

AUSTRALASIA
Trans-Australia Airlines
Ansett-A.N.A.
New Zealand National Airlines Corporation

PACIFIC
Philippine Air Lines
All Nippon Airways

VISCOUNT

FOUR ROLLS-ROYCE DART TURBO-PROP ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

MEMBER COMPANY OF BRITISH AIRCRAFT CORPORATION

TGA AT6 68

D

TO DATE 368 SUCCESSFUL ESCAPES

have been made using

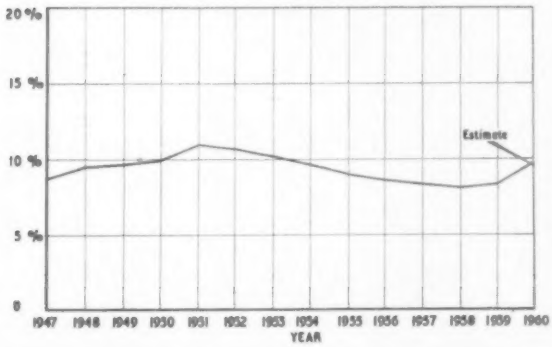
MARTIN-BAKER EJECTION SEATS

The result of 16 years experience and more than 850 test ejections.

MARTIN-BAKER

TABLE I

B.O.A.C. Traffic as Percentage of World International Traffic 1947—1960 (Load ton-miles)



1947	8.5%	1954	9.2%
1948	9.3%	1955	8.9%
1949	9.5%	1956	8.6%
1950	9.9%	1957	8.2%
1951	11.5%	1958	7.8%
1952	11.0%	1959	8.2%
1953	10.4%	1960*	9.7%

*Estimate.

(*Continued from page 154*)

Except for B.E.A. and for certain transport aircraft manufacturing successes, this adds up to a pretty dismal picture and the Government has rightly taken some steps to put things right. The rationalization of the independent airlines and the creation of the Air Transport Licensing Board are expected to help the private segment of the air transport industry. The rationalization of the manufacturing industry is intended, amongst other things, to benefit the manufacture and export of transport aircraft.

However, nothing has yet been done to encourage the development and sale of smaller civil aircraft nor to advance general aviation in this country. Action to ensure the more efficient provision and operation of ground facilities has, so far, also been completely lacking.

The corrective steps taken in the case of B.O.A.C. have been to appoint a new chairman and to make a number of other alterations to the board. What are the prospects of these changes achieving the desired results?

B.O.A.C. has had a difficult time ever since it was formed on Apr. 1, 1940. Born out of Imperial Airways at a critical time during the War, it started life as a sort of quasi-military transport service in the days before the R.A.F. had a proper air transport organization of its own.

To the end of the War, and for some time thereafter—long after the formation of R.A.F. Transport Command—B.O.A.C. continued to be a purely official organization carrying very largely Government-sponsored traffic and, indeed, discharging a function and operating in a manner not unlike that of Aeroflot in the U.S.S.R. today. Commercial considerations enter very little into the management decisions of this type of operator, so that it was some years after the War before B.O.A.C. began to get the economics of its operations on to a reasonably competitive basis.

It was not helped, moreover, in its efforts to turn itself into a commercial airline by difficulties with its equipment. B.O.A.C.'s aircraft policy-making after the War was, on the whole, not unsound. During the War, it appreciated the need for competitive piston-engined long-haul British transports to be available as soon as possible after peace returned and it did what it could to encourage the development of the "interim" Tudors and Hermes. It was not its fault that these aircraft proved to be uncompetitive. The Corporation was also far-sighted and energetic in its support of the Comet 1, and again was not responsible for the type's failure. However, it was slow in sorting out its Medium Range Empire requirement and was thus partly responsible for the Britannia "missing the boat" with World-wide sales in the long-haul field, which might otherwise have rivalled those of the Viscount. It also "boobed" badly in sticking to flying-boats long after such aircraft had been recognized as uneconomic by the more knowledgeable American operators. After the failure of the Comet 1, B.O.A.C. made, perhaps, its most serious mistake in turning down the Vickers V.1000 long-haul jet and in not sponsoring an alternative British design until long after the World-wide "jet-buying spree" of the middle 1950s had firmly established the American Boeing 707 and Douglas DC-8 as the main next-generation long-haul equipment of the World's airlines.

Although B.O.A.C.'s errors in aircraft planning are fairly easy to pick out now when looking back over the post-War years, some of the Corporation's other deficiencies are more difficult to identify. However, the soundness—or otherwise—of an airline's commercial and schedules planning, as well as of its aircraft policy, is usually clearly revealed, in the final analysis, by the extent to which the airline succeeds in attracting traffic away from the fierce competition which exists on almost every international route.

If we look at B.O.A.C.'s traffic as a percentage of World international traffic (Table I) we get a pretty good indication of how the Corporation has fared in this respect in recent years. The picture which emerges is that there was a steady improvement from the end of the War up to 1951-52; thereafter a more or less static position was followed by a relapse in 1953-54 after the Comet 1 withdrawal. Since then things have remained largely unchanged until the introduction of Britannias, Comet 4s and Boeing 707s in the past three years has begun to restore the position.

As already mentioned, it was the decline in B.O.A.C.'s share of World traffic in the mid-, and later, 1950s which was partly responsible for public disquiet about the British airline industry, but this is not to say that it was the only reason. Probably more important was B.O.A.C.'s relapse into a state of unprofitability after achieving its first overall profits from 1951-52. The decline is best expressed in terms of operating ratio, that is to say the relationship of annual revenue to expenditure. Table II shows that B.O.A.C. improved its operating ratio in spectacular fashion during the years after the War and continued to do so up to 1952-53, when the trend was checked at the time of the Comet disasters. A condition of marginal—or near—profitability was maintained thereafter until 1956-57 but, since then, there has been a serious decline which has, however, been arrested during the past year.

The recent reversal of the trend in operating ratio seems to be due, primarily, to the excellent progress which B.O.A.C. has made latterly in reducing its specific costs. As Table III shows, B.O.A.C. has made quite spectacular progress since 1957-58 in improving its efficiency. Cost per capacity ton-mile has, in fact, been reduced by no less than 27% during the past three years. Some of this progress is no doubt directly due to the improved equipment—Britannia, Comet 4 and Boeing 707—which has entered service, but there seems also to be little doubt that increased organizational efficiency, particularly on the engineering side, has also played a big part. Engineering costs per capacity ton-mile have, indeed, been almost halved during the past three years.

Table III shows that, from a position just after the War, when B.O.A.C.'s specific costs were nearly 50% higher than

TABLE II

BOAC Revenue, Expenditure and Operating Ratio 1947/48—1959/60

Year	Total Revenue (×£1,000)	Total Expenditure (×£1,000)	Operating ratio (per cent)
1947/48	15,233	22,814	66.8
1948/49	18,517	26,323	70.3
1949/50	20,531	28,323	72.5
1950/51	25,342	29,907	84.7
1951/52	34,618	34,341	100.8
1952/53	37,407	38,246	97.8
1953/54	40,061	39,000	102.7
1954/55	39,066	38,804	100.7
1955/56	47,207	47,089	100.3
1956/57	54,305	54,002	100.6
1957/58	63,443	66,282	95.7
1958/59	69,399	74,578	93.1
1959/60	84,000*	85,000*	98.8*

* Estimates.

TABLE III

BOAC and all ICAO Airlines Costs/CTM 1947/48—1960/61

Year	All ICAO Airlines (cents/CTM)	BOAC (cents/CTM)
1947/48	46.3	68.0
1948/49	44.8	59.0
1949/50	39.4	52.2
1950/51	36.5	47.5
1951/52	36.8	46.1
1952/53	37.1	48.0
1953/54	36.2	45.5
1954/55	35.0	46.2
1955/56	34.6	44.0
1956/57	35.0	46.4
1957/58	34.5	45.1
1958/59	33.2	42.2
1959/60	32.0	38.0
1960/61		33.0

Note: ICAO figures for calendar years.

the World average, they have now been reduced to about the average level. This improvement has been achieved in three stages. First, there were three years of rapid advance extending up to 1950-51, then an interval of seven years during which specific costs showed little improvement and fluctuated between about 44 and 48 cents per C.T.M. and, finally, another period of rapid improvement since 1957-58.

Thus, B.O.A.C.'s present cost trends suggest that the Corporation's condition is now fundamentally healthy and is, indeed, a great improvement on what it was four years ago when Sir Gerard d'Erlanger took over. These favourable trends should enable B.O.A.C. soon to re-establish itself in a fully profitable position. The Corporation should also be able to afford the further reductions in fares which are going to be essential on all the long-haul international routes if sufficient extra traffic is to be generated to fill to economic load factors the great increases in capacity provided by the many new large jets on order by most of the World's airlines.

Table IV compares trends since the War in B.O.A.C.'s average fare per passenger-mile with the average for the United States' international airlines and with the World average. It shows that, whereas the trend for the U.S. airlines has been steadily downward and that for the World has been more or less level, that of B.O.A.C. has tended upward. It is most unlikely that this trend can continue if B.O.A.C. is to maintain the recent increases in its share of the World's long-haul traffic.

To sum up, it would appear that there are good prospects that, under its new chairman, B.O.A.C. will now be able to go forward into its most successful period to date—a period during which it should be able to consolidate its financial position while maintaining a rapid rate of traffic growth which will give it an increasing share of World traffic. At the same time, introduction from 1963-64 of the V.C.10 and, later, of the Super V.C.10, should enable it, at long last, to establish itself in a long-term fully competitive position on all its routes while using British aircraft only.

B.E.A.'s prospects are equally encouraging.

It therefore appears that, after the difficulties of the 1950s, both Corporations can be expected to do well in the 1960s provided any changes in the licensing arrangements which the new Air Transport Licensing Board may introduce do not significantly undermine their prospects. If the Board discharges its difficult responsibilities to best effect in the National interest, however, it should be able to foster the further growth of the private element of the British airline industry without harming either of the Corporations. Indeed, unless it succeeds in this objective, the recent changes will do more harm than good.

With the airline industry set on its feet and the manufacture of transport aircraft reorganized, it remains to be seen what, if anything, the Government proposes to do about the other trouble spots of British Civil Aviation—the provision and operation of ground facilities, general aviation, and the manufacture of the smaller types of civil aircraft are all burning issues requiring urgent attention. Unless something is done about them quite quickly, the deficiencies in these sectors of British Aviation will continue to impose a serious brake on progress over the whole field.

Something must be done—and done soon.—" ANNALIST."

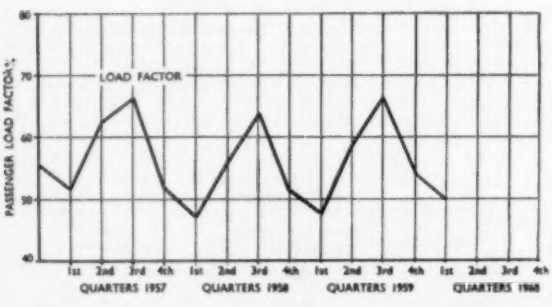
TABLE IV

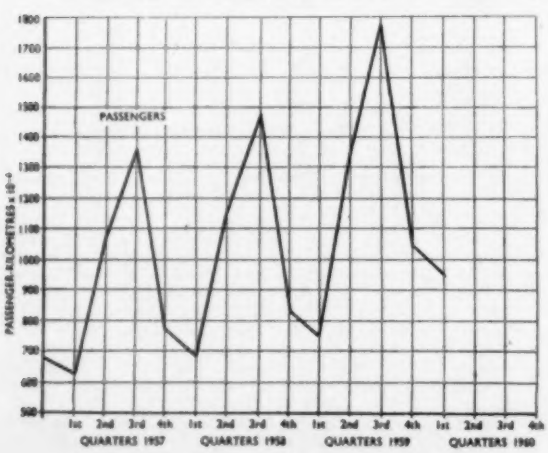
BOAC, U.S. International and all ICAO Airlines Fares/passenger-mile 1947/48—1960/61

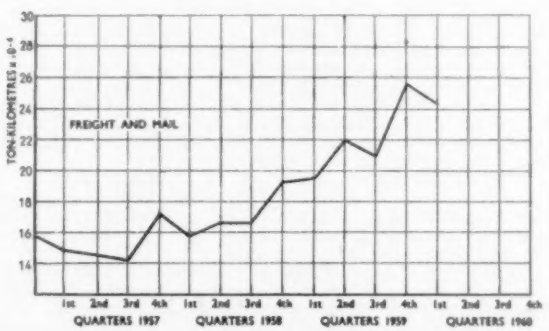
Year	All ICAO Airlines (cents/p.m.)	U.S. International Airlines (cents/p.m.)	BOAC (cents/p.m.)
1947	6.6	7.77	7.3
1948	7.1	8.01	6.9
1949	6.6	7.72	6.7
1950	6.3	7.28	7.1
1951	6.3	7.13	7.2
1952	6.3	7.04	7.4
1953	6.1	6.88	7.4
1954	6.1	6.79	7.3
1955	6.1	6.68	7.3
1956	6.3	6.70	7.5
1957	6.1	6.57	7.4
1958	6.1	6.51	7.5
1959	6.1	6.44	

Note: BOAC figures for financial years.

European Traffic Trends







IN the first quarter of this year the international intra-European passenger traffic of the 12 member airlines of the Air Research Bureau increased by 23%, and the freight traffic increased by 27%. The recovery in the growth rate of passenger traffic which began in 1959 has therefore been maintained, and has been accompanied by successive improvements in the load factor. Results for the first quarter and for the year ending March, 1959, are tabulated here, and the trends of the past three years are shown in the graphs.

Introduction of new aircraft led to an increase in the average number of seats per passenger flight to 54. In the first quarter of 1958 the figure was 48. A further growth in jet traffic was recorded, to 9.3% of the total compared with 8.2% in the previous quarter (see our issue for Jne. 10, p. 699).

	1st Quarter		1960 as % of 1959	12 mths. ending		1960 as % of 1959
	1959	1960		Mar. 1960	Mar. 1959	
Seats/km. (million) ..	1589	1886	119	7863	8771	112
Pass/km. (million) ..	766	945	123	4393	5107	116
Pass. load factor % ..	48.4	50.0	—	55.9	58.2	—
Freight tonne/km. (mill.)	15.7	20.0	127	59.8	75.8	127
Mail tonne/km. (million)	3.8	4.3	114	15.6	17.3	111

Intra-European traffic includes all traffic carried on international routes originating and terminating within the European continent and countries bordering the Mediterranean. Airlines included in this survey are:—Aer Lingus, Air France, Alitalia, B.E.A., Finnair, Lufthansa, Iberia, Icelandair, K.L.M., S.A.S., Sabena and Swissair.

The Fighting Services

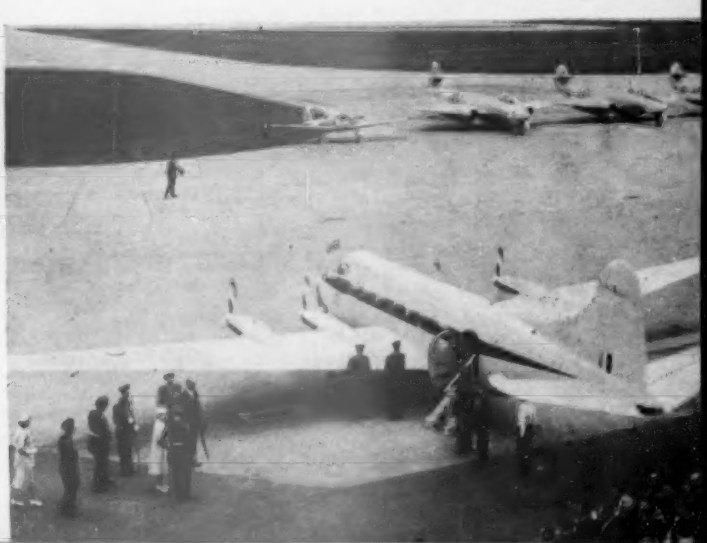
Cranwell's Royal Visit

On July 25 H.M. The Queen with H.R.H. The Prince Philip, Duke of Edinburgh, flew to the R.A.F. College for the passing out of No. 77 Entry. Her Majesty, who became Commandant-in-Chief of the College on June 1 last, reviewed the parade and then planted a tree to commemorate the 40th Anniversary of the College.

Her Majesty, accompanied by Air Cdre. D. F. Spotswood, the Commandant, going to plant the tree.

The Queen, wearing pink, was obviously enjoying her visit.

The six prize-winners (L. to R.) S.F./C. M. D. Evans; S.F./C. R. M. Prothero; S.U./O. N. Bonnor (Queen's Medal); S.U./O. P. J. Kemp (Sword of Honour); S.U./O. M. B. Bullocke; S.F./C. J. P. P. Browne



Above, Cadets in review order. Right, Her Majesty taking leave of her hosts.

The Fighting Services . . . .

R.A.F. Soaring Championships

ALTHOUGH long or outstanding flights were not possible due to the very unfavourable weather, the R.A.F. Inter-Command Soaring Championships, which were held at R.A.F. Station, Odiham, were extremely successful.

Sgt. John Williamson, flying an Olympia 419, became the new R.A.F. soaring champion, scoring 294 points out of a possible 400. The Command Trophy was won by the team from R.A.F. Germany, whose pilots, Wg. Cdr. Joe Croshaw and Sgt. Andy Gough, gained second and fifth places; runner-up was Technical Training Command and third Maintenance Command.

After a good opening day, Jly. 15, when several pilots reached the Norfolk coast, the weather deteriorated, and the next best day was Jly. 19, when competitors flew westwards in a light northerly wind and John Williamson reached Crediton in Devon. Jly. 20 was barely a contest day, as only five people scored marks in an attempted race to Shoreham; but Jly. 21 provided a west wind in which everyone made for the far end of Kent and some got into cu-nims there, but were not allowed to cross the Channel.

R.A.F. GLIDING—LEADING SCORES

Pilot	Sailplane	Command	Points
Sgt. J. Williamson	Olympia 419 ..	Technical Training ..	294
Wg. Cdr. J. Croshaw ..	Skylark 3f ..	R.A.F., Germany ..	266
Flt. Lt. F. D. Cretney ..	Skylark 3b ..	Maintenance ..	196½
Flt. Lt. G. A. Coatesworth ..	Olympia 401X	Bomber	185½
Sgt. A. Gough	Skylark 3b ..	R.A.F., Germany ..	157½
Gp. Capt. N. W. Kearon ..	Skylark 3b ..	Maintenance ..	146½
Flt. Lt. A. Loveland	Olympia 2b ..	Bomber	133½
Plt. Off. G. Barrell	Olympia 2b ..	Flying Training ..	98½
Flt. Lt. Spotteswood	Olympia 2b ..	Technical Training ..	98
Cpl. Tech. C. P. Jeffery ..	Olympia 2b ..	Maintenance ..	98

Plt. Off. Barrell and Cpl. Jeffery flew on only 3 contest days.

The Championships were organized by the R.A.F. G.S.A. and much of the credit for its success is due to the extremely efficient handling by Gp. Capt. Roy Goodbody. The operations room, run by Sqn. Ldr. Norman Maygothling, was well up to the National Championship standard. Task setting by Air Cdre. C. Paul and Wally Kahn was complicated by the unending stream of westerly winds which meant that cloud flying was not possible due to the complex airway and control pattern in southern England. The weather was ably forecast by Jock Findlater of the Met. Office.

The contest also provided an opportunity for the R.A.F. G.S.A. committee to select a team to compete against the Navy and Army in the Inter-Service Championships which started at Odiham on Sunday, Jly. 24, the day after the R.A.F. contest finished. The R.A.F. team comprised the first seven pilots in the table plus Flt. Lt. R. A. E. Dunn.

It is well worth noting that the standard of soaring in the R.A.F. is very high indeed. Already two of Britain's top ten pilots are members of the R.A.F. and within the next few years this number will no doubt be increased. The quality of their gliders and equipment is second to none and the keenness and enthusiasm of their members is a joy to behold.

Inter-Services Soaring

THE R.A.F. entered the Inter-Service Championships at Odiham, on Jly. 24 as the favourites. Although the other two Services have not been able to reach the same high standard in men and machines, the Army Gliding Association team led by Maj. Sir Charles Dorman, was very strong. Gliding in the Army has increased greatly in recent years and is now a well-established sport for all ranks. The Navy, unfortunately, appeared to be badly placed and were only able to produce a team, led by Cdr. Tony Goodhart, by borrowing two private owners' gliders to supplement their other machines. This seems strange when one remembers how much post-War gliding in this country owes to the Goodhart brothers.

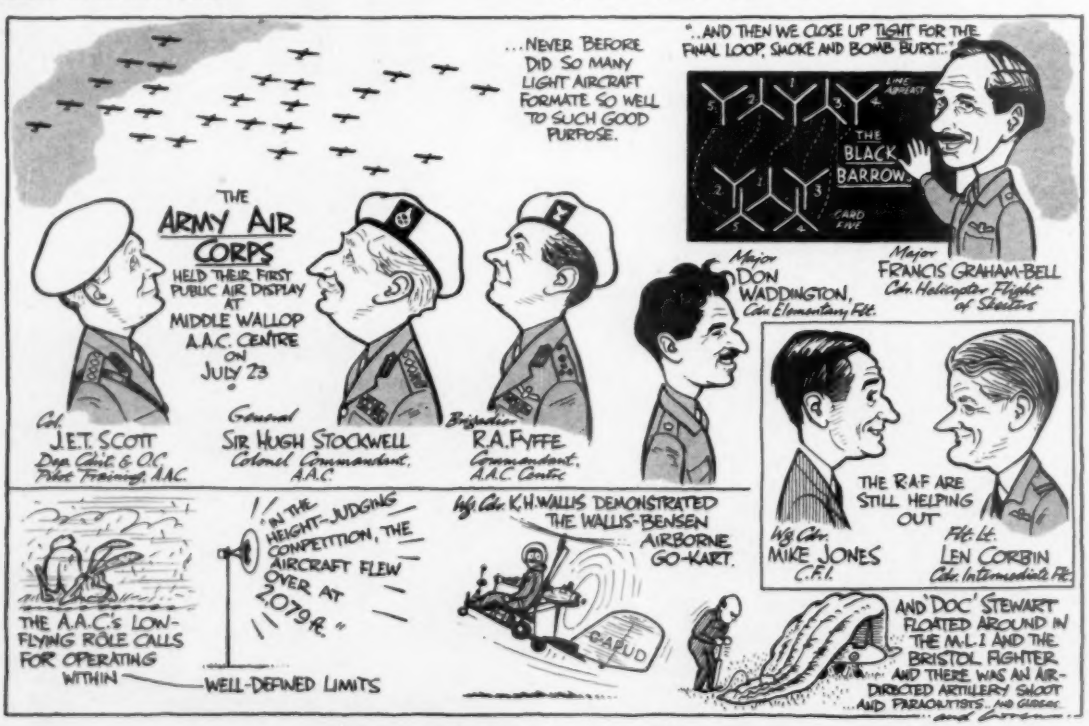
After only two contest days, the R.A.F. team led by a comfortable margin, but the top-scoring Service pilot at that time was Capt. Ted Shephard, of the Army Air Corps.

Monday, Jly. 25, was quite a good day. At Odiham the task was distance along a line going E.S.E. to Firle Beacon and then E.N.E. to Deal. This made 119 miles from the release point over Lasham, and five pilots reached Deal: Sgt. John Williamson and Flt. Lt. F. D. Cretney for the R.A.F., W/O E. Stark and Capt. E. C. Shephard for the Army, and David Ince flying *hors concours*. Flt. Lt. G. A. Coatesworth, Sgt. Andy Gough and Wally Kahn were the only others to pass Firle, 56 miles out.

More Service News

Record Service.—Air Cdre. W. I. G. Kerby, C.B.E., the oldest serving officer with the longest period of service in the R.A.F. has retired. Joining the R.F.C. in 1917, he rose through every rank of the R.A.F. Police to become Provost Marshal with 43 years' service.

Ten Thousand Broadcasts.—The F.E.A.F. "Voice Flight" (Flt. Lt. H. Haines) equipped with two Dakotas and based on the island of Penang, recently logged its 10,000th broadcast. During the past six years the flight has been operated by three different squadrons—Nos. 267, 209 and 52.


...NEVER BEFORE DID SO MANY LIGHT AIRCRAFT FORMATE SO WELL TO SUCH GOOD PURPOSE.
"...AND THEN WE CLOSE UP TIGHT FOR THE FINAL LOOP, SMOKE AND BOMB BURST."
THE BLACK BARROW
THE ARMY AIR CORPS HELD THEIR FIRST PUBLIC AIR DISPLAY AT MIDDLE WALLOP A.A.C. CENTRE ON JULY 23
Col. J.E.T. SCOTT Dep. Chief S. O.C. Pilot Training, A.A.C.
General SIR HUGH STOCKWELL Colonel Commandant, A.A.C.
Brigadier R.A. FYFFE Commandant, A.A.C. Centre
Major DON WADDINGTON, Cdn. Elementary Flt.
Major FRANCIS GRAHAM-BELL Cdr. Helicopter Flight of Skeeters
THE R.A.F. ARE STILL HELPING OUT
Wg. Cdr. MIKE JONES C.F.I.
Flt. Lt. LEN CORBIN Cdr. Intermediate Flt.
"IN THE HEIGHT-JUDGING COMPETITION, THE AIRCRAFT FLEW OVER AT 2,079 ft."
THE A.A.C.'s LOW-FLYING ROLE CALLS FOR OPERATING WITHIN WELL-DEFINED LIMITS
Wg. Cdr. K. H. WALLIS DEMONSTRATED THE WALLIS-BENSEN AIRBORNE GO-KART.
CAPUD
AND 'DOC' STEWART FLOATED AROUND IN THE M.L.I AND THE BRISTOL FIGHTER AND THERE WAS AN AIR-DIRECTED ARTILLERY SHOOT AND PARACHUTISTS AND GLIDERS and Gunners

The Army's Air Day at Middle Wallop.

D.H. Propellers for the Tyne

WITH the rapid advances in aircraft and aero-engine development made in recent years — particularly in regard to the use of turboprop powerplants—there have been correspondingly noteworthy developments in propeller design and technology. The modern aircraft propeller is, in fact, a complex mechanism capable of absorbing thousands of horse-power; and safety as well as efficiency has to be a predominant consideration.

One of the most recent units in the de Havilland range of variable-pitch feathering and reversing propellers is that designed for the Rolls-Royce Tyne. Its mechanism and systems layout are shown in the drawings on the following pages.

Principal among the features of special interest in this particular propeller are the methods that have been devised to overcome the problems associated with windmilling drag and overspeeding. Discounting a major structural failure, these are the two most significant dangers to be considered.

In the event of an engine power failure the r.p.m. will immediately fall. The propeller controller (C.S.U.), sensing this fall, will endeavour to maintain the r.p.m. selected at the time of failure by feeding a fine-pitch signal to the blades.

The opposing force to the continued rotation of the propeller is the resistance or "motoring power" of the failed engine. With the subsequent reduction in pitch, the blades will reach an angle at which they will absorb power from the airstream sufficient to overcome this resistance and drive the engine at the original selected r.p.m. The resulting drag in the case of a twin-spool engine such as the Tyne would rapidly build up and in the absence of any safety features could exceed 15,000 lb., thus imposing loads on the aircraft sufficient to cause loss of control or possibly a major structural failure.

If a failure occurs where control of the propeller is lost, the blades will assume a fine angle due to external forces acting upon them. These forces, known as centrifugal twisting moment and aerodynamic twisting moment, increase with the size of the blades.

As the blades reduce pitch the load on the engine will reduce but its power output will remain substantially unaffected, and since power is proportional to the product of torque and r.p.m., the r.p.m. must inevitably rise. Assisting this rise is the windmilling effect of the airstream and again, in the absence of any safety features, the assumption of a very fine blade angle would be almost instantaneous.

An uncontrolled overspeed could reach a figure where the centrifugal forces on the structure might well impose loads outside the design limits of both propeller and engine. If engine power is reduced to combat the overspeed, the propeller will windmill and more drag will be induced.

Safety Features

It was, then, necessary to ensure that under no circumstances could the propeller assume too fine a pitch in flight. Various schemes were investigated and after searching analysis the following seven features were built into the system:—

(1) An automatic drag limiting system (A.D.L.S.), sensitive to engine shaft torque. (2) A mechanical pitch lock, responsive to loss of control pressure and propeller overspeed. (3) A hydraulic pitch lock, responsive to loss of control pressure. (4) A mechanical flight fine-pitch stop. (5) A secondary electro-hydraulic flight fine-pitch stop. (6) A "Beta" hydraulic follow-up stop. (7) Two independent means of feathering.

In view of the very high drag that could be produced, it is necessary to detect an engine failure immediately and reduce the drag by coarsening the pitch of the propeller blades. The system is sensitive to any unscheduled fall in torque in the propeller shaft and is actuated mechanically by the engine reduction gear. A fall in torque moves an annulus gear, on the reduction gear, which is linked to a servo-valve in the controller and directs high-pressure oil into the coarse-pitch line, instantly "coarsening" the propeller.

The setting of torque values for the initiation of the system is varied by the power lever, giving a small positive torque in the take-off and cruise positions, and a negative value at flight idle. When operating above the flight idle position the system will coarsen the blades almost to feather. At flight idle, the resultant increase in blade pitch will produce a smaller negative torque value and cancel the system until the pre-set value is again reached. This results in a "hunting" condition, the system controlling pitch to maintain this negative torque value.

Propeller System

The complete Tyne unit comprises a Hydromatic fully feathering and reversing propeller provided with blade angle (Beta) control to facilitate ground handling and reversing; an engine-mounted controller (P.C.U.) for constant-speed and Beta operation; an independent electrically driven feathering pump; electro-thermal de-icing; a conical spinner, and phase synchronization equipment.

Operation of the propeller is based on the well-established Hydromatic principle, incorporating spider, split barrel, single roller-bearing blade retention and a pitch-change motor. The motor comprises, basically, the dome, the piston and two cylindrical cams mounted co-axially within the piston. The outer of these cams is stationary in relation to the propeller hub, and the inner free to rotate.

Longitudinal movement of the piston is translated, through rollers operating in slots in the cams, to rotational movement of the inner cam. A bevel gear ring attached to this cam, and meshed with gear segments on each blade root, brings about the change of blade angle.

Total pitch range is 120°, and a variation of the slope of the cam slots provides the appropriate rates of pitch change for constant speeding, feathering and reverse. Adjustable stop rings restrict the movement of the gear ring, and thus blade angle, at the feather and reverse positions.

The mechanical flight fine-pitch stop is mounted within the piston and consists of 24 latches which engage on a stop ring to provide a positive limit to travel in the fine-pitch direction during flight. After touchdown, the power lever, in selecting Beta, hydraulically removes a restraining disc by energizing a third oil line, allowing the latches to fall out of engagement and the piston to move forward into the low-pitch range for reversing and ground handling.

Included in the pitch change are two more of the safety features of the propeller—the mechanical pitch lock and overspeed sensor, and the hydraulic pitch lock. The primary feature is the mechanical lock. This is basically a pair of ratchet-toothed rings, one attached to the rotating cam of the pitch-change piston, and the other splined to the propeller hub. The lock is normally held open by fine-pitch pressure acting on a spring-loaded piston.

A loss of this pressure results in the engagement of the rings, under the action of multiple springs, thus locking the rotating cam and preventing movement of the blades towards fine pitch. The ratchet teeth allow movement towards coarse pitch and feather.

In the overspeed case, a flyweight governor-operated valve senses any abnormal rise in r.p.m. and cuts off the pressure behind the spring-loaded piston. The oil present is released and the multiple springs force the lock into engagement.

The governor has two settings—the low one operates approximately 5% above cruise and the high at 5% above take-off r.p.m. Changeover is automatic as the power lever is advanced beyond the max. cruise position. A functioning check of the lock can be made by a push button in the cockpit.

Successfully featured in de Havilland propellers for many years, the hydraulic pitch lock is a simple spring-loaded valve held open by pressure in the fine-pitch line. Should a loss of pressure occur, the valve closes, trapping the oil on the coarse-pitch side of the pitch-change piston, so preventing any movement towards fine.

At the rear of the propeller is a rocker and plunger mechanism which, operating on a thrust plate, imparts the blade angle feedback signal from the special cams on the blade roots, via a linkage, to the controller on the engine. The spinner drive plate is bolted to the rear of the hub and houses the de-icing brush packs, the heating current transfer being carried out by a slip ring fixed to the front of the engine.

The controller is mounted on the engine and driven by the low-pressure compressor. It embodies a large gear-type pump and a pressure demand type relief valve. The functions of the unit are: to control propeller r.p.m. during normal governing, and blade angle when Beta is selected; to withdraw the

fine-pitch stop after landing; to select feather; and to limit drag in the event of an engine failure.

A conventional flyweight governor operating the main control valve is employed, with the r.p.m. selection interconnected with the engine fuel control, being progressively increased with fuel flow as the power lever is advanced, by altering the pressure on the governor spring. An independent coarse-pitch valve is included in the controller, which is brought into operation by a servo valve actuated by the mechanical linkage of the A.D.L.S., or by a solenoid valve energized from the feather control in the cockpit.

A third oil line supplies pressure to withdraw the mechanical fine-pitch stop on selection of Beta, and also, at different pressure levels, operates the datum changeover of the overspeed pitch lock setting. The head of the controller houses the engine speed and Beta control mechanisms, the engine interconnection levers and the phase synchronization actuator.

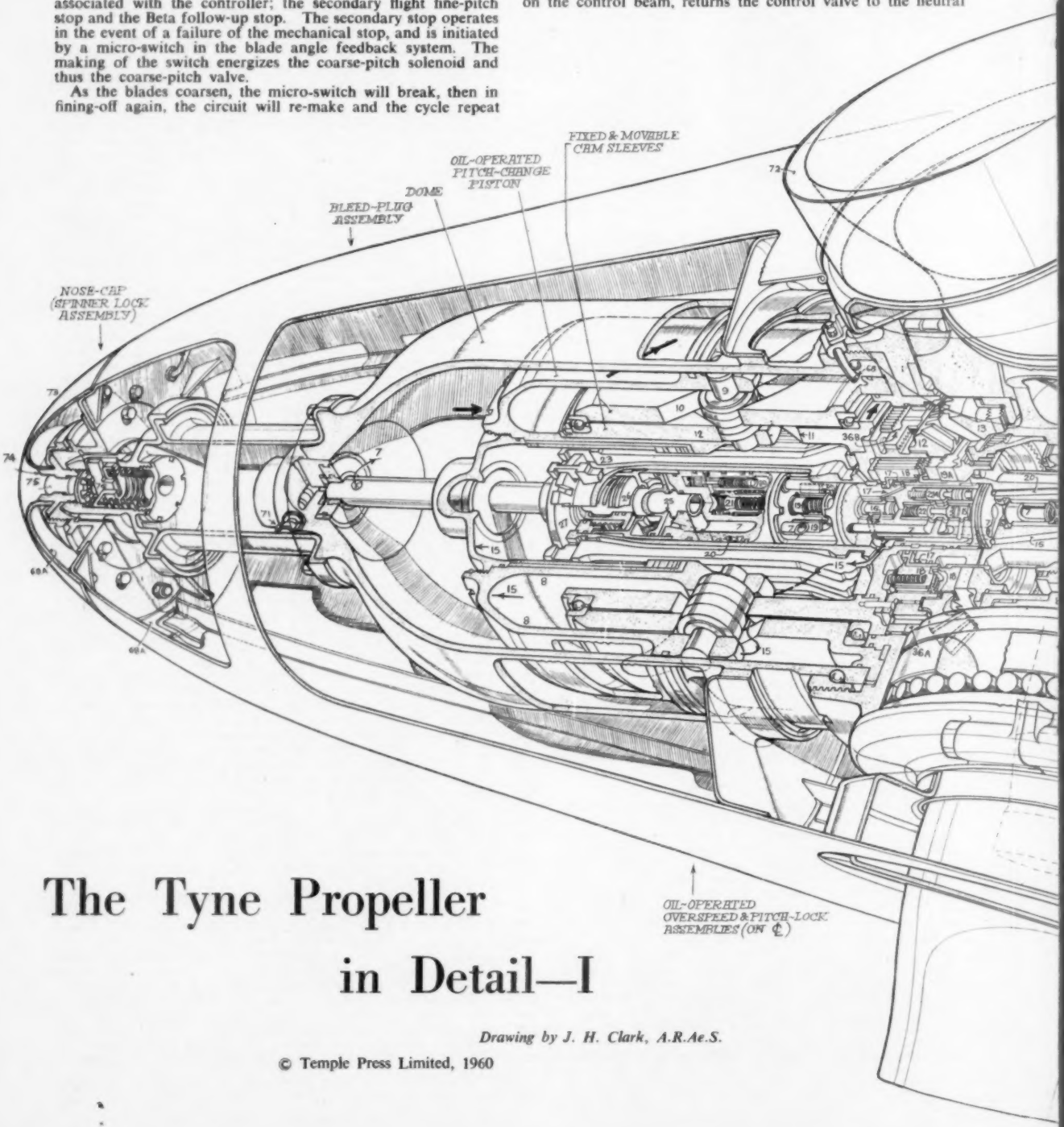
Apart from the A.D.L.S., two other safety features are associated with the controller; the secondary flight fine-pitch stop and the Beta follow-up stop. The secondary stop operates in the event of a failure of the mechanical stop, and is initiated by a micro-switch in the blade angle feedback system. The making of the switch energizes the coarse-pitch solenoid and thus the coarse-pitch valve.

As the blades coarsen, the micro-switch will break, then in fining-off again, the circuit will re-make and the cycle repeat itself. The result will be a hunting of the propeller, but the pitch change is so small and the cycle so rapid that it will have no effect on the aircraft.

Beta control is inoperative in flight. However, a cam which forms part of its mechanism is set so that with the power lever in the flight range, it operates to close the main control valve should the blades tend towards too fine a pitch for the r.p.m. selected. The Tyne engine is the first in this country to be fitted with Beta control.

Selection of Beta starts with the operation of an arming-lever, then as the power lever is moved into Beta range the flight fine-pitch stop is withdrawn. The normal governor operation of the main control valve is overridden and movement of the power lever rotates a Beta set cam in the controller head. The action of this cam is to raise or lower a control beam which, in turn, operates the control valve.

As the blades respond, the cams on their roots actuate the feedback linkage to rotate a Beta feedback cam, which, acting on the control beam, returns the control valve to the neutral



The Tyne Propeller in Detail—I

Drawing by J. H. Clark, A.R.Ae.S.

© Temple Press Limited, 1960

position so that pitch changing ceases when the desired blade angle is achieved. Power and blade angle are thus co-ordinated to give the pilot an infinitely variable control of positive or negative thrust for ground handling and reverse operation.

The output of the feather pump alone is capable of the operation up to an overspeed of 41% max. continuous r.p.m. and 30% of take-off r.p.m. Oil for the operation is returned to a reservoir in the main tank.

It is a well-established fact that by synchronizing the speed of the propellers the noise level in the aircraft is considerably reduced, but a further reduction is possible if the blades of adjacent propellers are held in an angular relationship. In the system fitted to the Vanguard, a tacho-alternator driven at four times propeller speed is mounted on each engine, producing a phase and r.p.m. reference for that propeller.

These references are fed into a computor, where the signals from slave and master are compared. A corrective signal is sent to the appropriate actuator on the relevant controller varying the setting of the governor spring, so bringing that propeller into line. With the system, synchronization is effected if the r.p.m. is set to within 150 L.P. r.p.m. and phase relationship is maintained to within 8° of blade position.

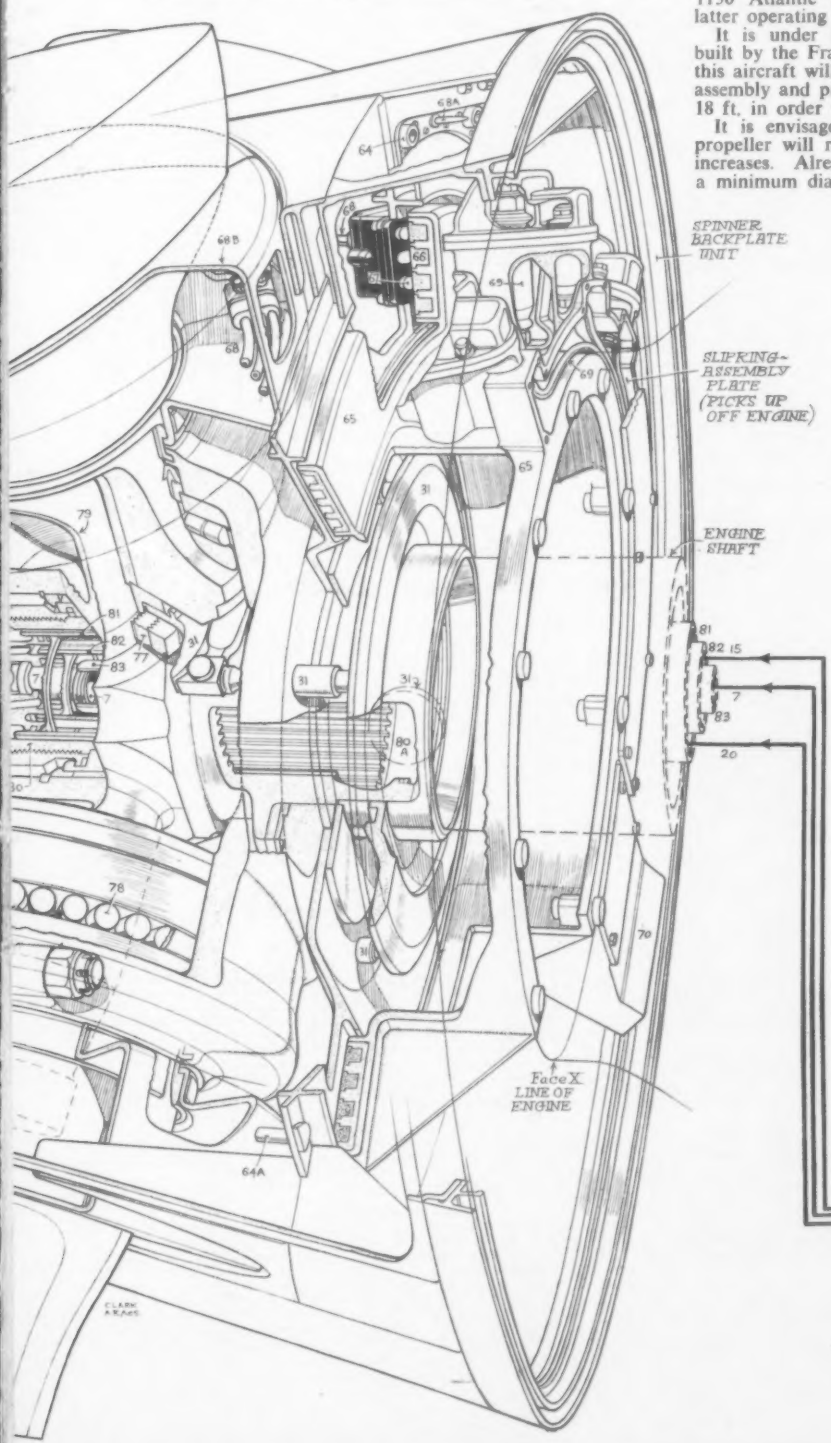
Future Developments

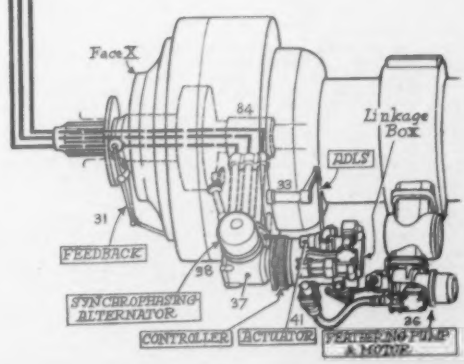
To date, more than 10,000 hours have been run with the Tyne propeller on the testbeds and in flight. It is currently fitted to the Vickers Vanguard and so far a total of 1,350 flying hours has been accumulated under test-flying and route-proving conditions. In Canada the Canadair CL.44 with the 16-ft.-diameter propeller has completed nearly 100 hours on flight trials. Other aircraft scheduled for fitment are: the Short Britannic, the Westland (Fairey) Rotodyne, and the Breguet 1150 Atlantic NATO maritime reconnaissance aircraft, the latter operating with the Tyne up-rated to 5,665 s.h.p.

It is under negotiation for the Transall C-160 transport built by the Franco-German consortium. The installation for this aircraft will be a four-bladed propeller with a larger hub assembly and pitch change. The diameter will be extended to 18 ft. in order to meet the stringent take-off requirement.

It is envisaged that the fundamental design of the Tyne propeller will remain unchanged as the power of the engine increases. Already an installation to absorb 10,000 s.h.p., with a minimum diameter of 20 ft., is being investigated.

—M. E. L. EVANS.

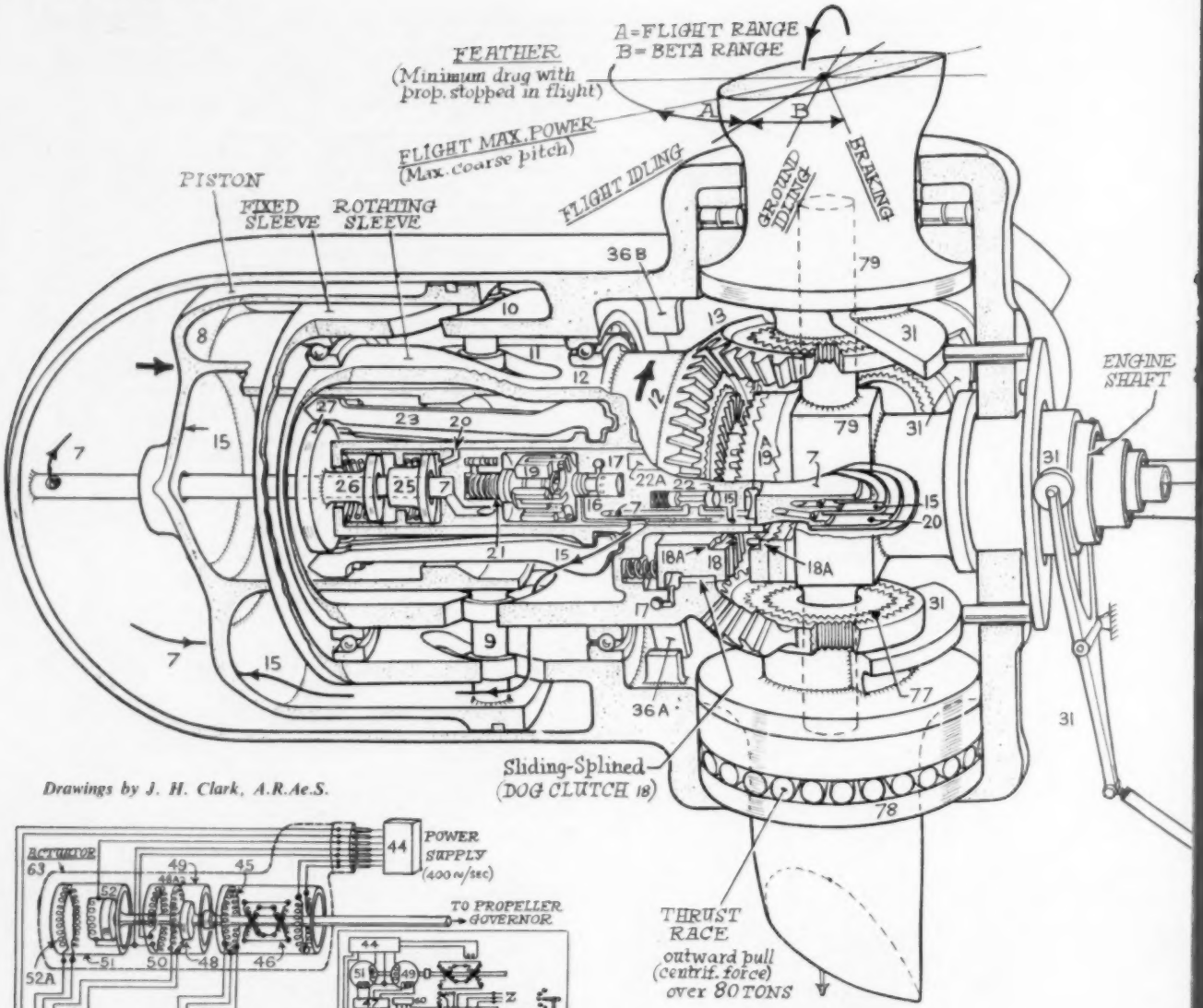




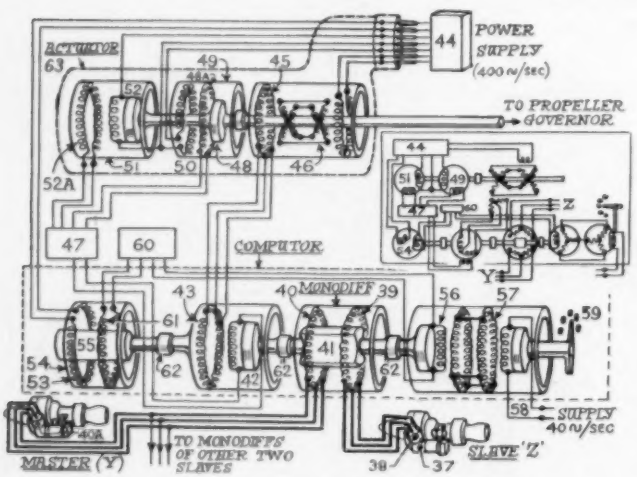
Key

Items not included in this key are on drawing over page.

7. Coarse-pitch line.
8. Piston.
9. Pin and rollers.
10. Slot in fixed sleeve.
11. Slot in moving sleeve.
12. Bevel gear.
13. Blade bevel.
15. Fine-pitch line.
16. Valve.
17. Oil chamber.
18. Dog clutch.
18A. Clutch pins.
19. Overspeed governor.
19A. Self-aligning coupling.
20. Third oil line.
21. Governor spring.
22. Hydraulic pitch lock.
22A. Non-return valve.
23. Arms (twenty-four) for flight fine pitch stop mechanism.
25, 26. Servo piston and flange 27.
31. Follow-up linkage.
33. Drag-limitation system linkage.
36. Feathering pump.
36A. Feathering stop.
37. Gearbox.
38. Synchronism gearbox.
38B. Reverse stop.
64. Spinner sockets.
65-68B. Backplate and spinner anti-icing.
69. Phase suppressors.
70. Terminal box.
71. Bleed plug.
72. Foam filling.
73-76. Spinner attachment.
77. Vernier adjustment.
78. Thrust race.
79. Blades.
80. Four-armed spider.
80A. Splined hub.
81-83. Oil pipes.
84. Sleeve.



Drawings by J. H. Clark, A.R.Ae.S.



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The Tyne Propeller in Detail—II

Key

Pilot Moves Power Lever Into TAKE-OFF

1. Fuel full on, engine speeds up, governor 1 (solid with drive shaft 2 and pump 3 fed from engine lubrication system) raises control valve 4 to route oil 5 (from engine through pump and increase-pitch valve 6) through coarse-pitch line 7 to push propeller piston 8 as arrow (governor and pump driven off engine 5A).
9. Pin 9 held in 8 moves along fixed slot 10. Slot 11 in sleeve 12 follows to rotate sleeve and bevel 12 as arrow to turn blade-bevels 13 (and blades) for pitch-change into coarser pitch; speed drops as blades absorb the power—governor closes and valve 4 drops to cut off further coarsening.

Pilot Moves Power Lever Down FLIGHT RANGE

14. Fuel reduced and linkage 14 drops to depress 4 to re-route pump oil into "fine" circuit 15 behind piston to fine-off blades. "Coarse" oil suitably piped back to pump. Governor 1 reacts to cut-off "fine" oil when prop. has met new power conditions and pump will be suitably short-circuited (5B) (14A, r.p.m. datum adjuster).

Mechanical Pitch Lock

16. Some "fine" oil up via valve 16 to 17 to blow spring-loaded dog clutch 18 apart. At overspeed, O/S governor 19 operates 16 to cut oil to 17 when clutch 18 will snap close to lock blades to prevent their fining-off (Ratchet profile of dogs allows movement towards INCREASE but not to DECREASE.) (O/S governor operates at slightly above either cruising or max. r.p.m.) Changeover is by lever 20A routeing 3rd line oil via 20 to activate spring 21 to raise governor datum.

18A. Pins run in groove. Where groove "fills up" pins pushed out to hold dog clutch open (Beta range and from feather to just below feather).

19A. Self-aligning transmission from hub.

Hydraulic Pitch Lock

22. On way to piston 8, "coarse" oil 7 passes through 22, held open by "fine" oil 15 against spring. Oil failure anywhere in engine system cuts 7 at once to trap piston 8 and hold it against fining-off.

22A. Non-return valve passes 22 to allow prop. to be coarse-pitched after 22 has locked.

Flight Fine-pitch Stop

23. Twenty-four arms 23 prevent piston 8 from moving so far that blades pass flight-idle during flight.

Pilot Moves Into Ground Handling After Touchdown (Called for short Beta—Blade Angle—Range)

Linkage 14 further moves to lower 4 to apply "fine" oil to piston. Arm 24 moves to route oil 20 to servo-piston 25 and 26 (one-piece with flange 27). Flange 27 moves forward and arms 23 drop in for 8 to pass. Further pilot action presses governor 1 right down (governor cannot operate). Control valve 4 and therefore blade angle (tied to engine power) comes under direct manual control via cam 28.

28. Cam 28 moves to move 29 round on to low-track of cam 30. Blade movement causes blade-cams and follow-up linkage 31 to move 30, raise 29 and 31A to raise valve 4 as a follow-up counter to pilot's "fining" action.

Secondary Safety-stop and Indication (Operates at 3° below Flight-fine Stop if that plus Beta control fails)

32. "Switchettes" operated by feed-back directs oil to 34 to move valve 6 to by-pass 4 and route pump-oil direct to "coarse" line.

Automatic Drag Limitation System (ADLS)

33. The propellers drive the aeroplane, but if an engine fails then aeroplane drives that prop. The engine torquemeter system notices the reverse-torque and signals down linkage 33 to shunt oil into 34 to depress 6 to by-pass 4 to route pump oil into "coarse" line (right on up to Feather if need be, with engine stopped).

Feathering

35. Pilot moves fuel/feather lever to cut off power and turn 35 to raise 31A and valve 4 to route pump oil into "coarse" line, and switches in feathering pump 36 additionally. (36 alone will feather prop.)

36A. Feather stop.

36B. Reverse stop

RPM Synchronizing

37. Gearbox 37 driven off engine drives 3-phase alternator 38 (as well as controller pump, etc). Alternator output goes to stator 39 where it is compared for frequency (prop. speed) and phase relationship (prop. position) with output of alternator from engine chosen as Master (40A fed into 40). Any out-of-speed will induce rotor 41 to rotate and turn 42 to change flux linkage between 42 and 43 (43 excited by supply 44 via double transformers 45). Rotors 46 are inter-connected mechanically and electrically.

Impulse will be induced in 42, amplified at 47 on to one stator winding 48A of 2-phase actuator motor 49 (stator winding 50 excited from 44). Actuator rotor 48 moves to control pitch (thus speed) via beam 14 and valve 4. Feed-back generator 51 (rotor 52 excited from 44) delivers via field 52A to 47 to stabilize system against hunting, etc. Rotation of rotor 48 through reduction gear of 1012:1 rotates rotors 46. Output of stator 45 disturbed and error signal fed from 45 on to 43 to neutralize previous impulse change in 42 and so stop actuator. Engine speeds are *still* unequal so 41 moves again (cycle repeated and stopped "inch by inch" until parity achieved).

Phase Synchronizing (To put propellers in step)

If props. are out of step engine must be accelerated (to "catch up") then drop back into equal speed to the master's. Synchrophase alternator 38 is set to deliver at fixed position to prop. blade angle so "props on-phase" means 40 and 39 in step and no rotation of 41. With out-of-step, 41 will move to move 56 and change flux linkage in double-transformer 57 energized from 58 (59 control knob to adjust prop. datum).

Impulse from 56 via 60 to another field 61 of motor 54 to turn 43 and so change flux linkage with 42. Impulse 42 via 47 to 48 to speed up engine. Monodiff 41 moves to get synchronism again, 42 moves same way as 43, restores balance, impulse via 47 ceases, actuator 49 stops. We are now back in synchronism and have "jumped nearer" to "in-phase." Cycle repeated (41, 65, 61, 43, 42, 47, 48) until "in-phase" achieved (along with synchronism).

62. Speed-up gears.

63. Actuator.

In General

64. Spinner sockets (at back) to fix on to plugs 64A.

65. Backplate fixed to engine, with sliprings 66 (spinner and blades anti-icing) brushes 67 and wiring 68, mats and plugs 68A, heater element in top surface of seal 68B.

69. Phase suppressors (3-phase anti-icing supply) and cables to terminal box 70.

71. Bleed plug to release piston pressure before dismantling.

72. Foam filling (profiling).

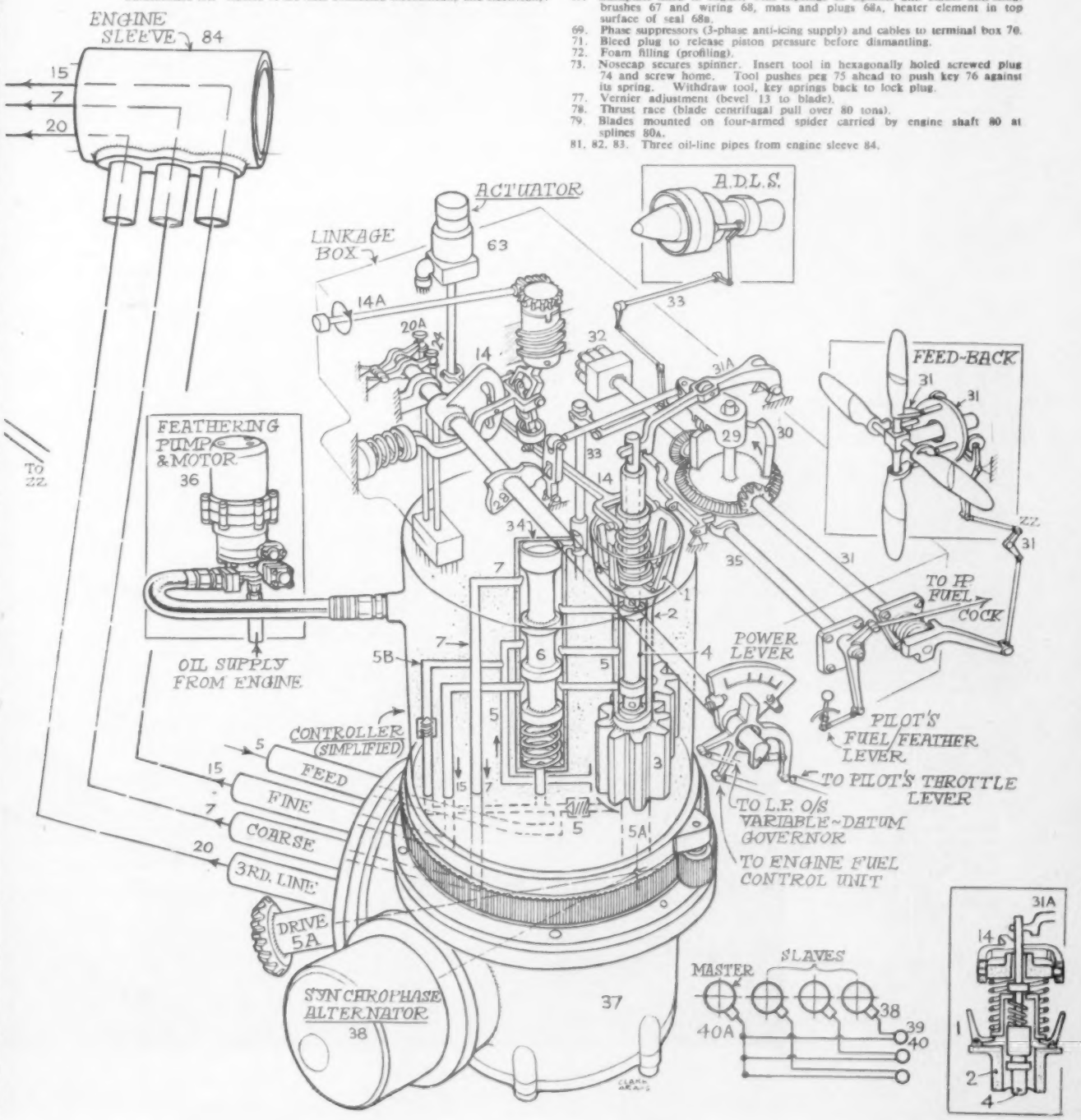
73. Nosecap secures spinner. Insert tool in hexagonally holed screwed plug 74 and screw home. Tool pushes peg 75 ahead to push key 76 against its spring. Withdraw tool, key springs back to lock plug.

77. Vernier adjustment (bevel 13 to blade).

78. Thrust race (blade centrifugal pull over 80 tons).

79. Blades mounted on four-armed spider carried by engine shaft 80 at splines 80A.

81, 82, 83. Three oil-line pipes from engine sleeve 84.



Israel's Aircraft Industry

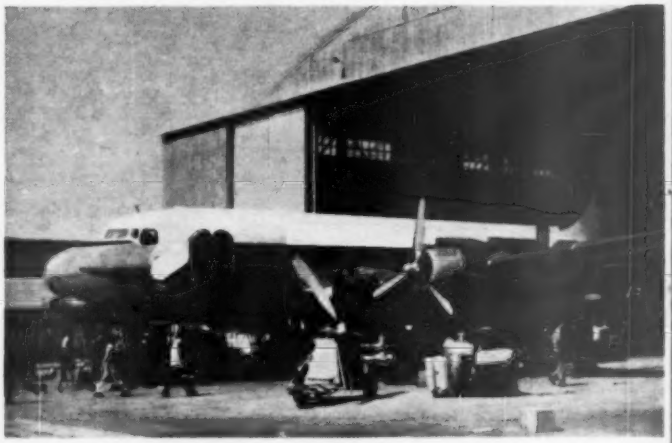
LITTLE information has so far been made available from Israel concerning industrial aviation activities there. The following notes from Israel Aircraft Industries—formerly Bedek Aircraft—in Tel Aviv are, therefore, of particular interest. This company, it will be recalled, was in the news recently having completed its first Fouga Magister jet trainer built under licence.

From a humble beginning, as an overhaul and maintenance base designed to serve the needs of local aviation, Bedek Aircraft has evolved within the span of five years into a manufacturer of modern jet aircraft, and a company having multifarious technical services. Its plant facilities may seem small by some aviation standards, but the true measure of the company's size can be appreciated when it is borne in mind that it has had to be grown and nurtured within a country of only two million people and with a relatively undeveloped industrial base.

At present employing more than 2,000 workers, Israel Aircraft Industries represents the largest concentration of industrial skills and equipment to be found, within a single centralized plant, anywhere in Israel. It is now fully equipped to perform maintenance and overhaul work on a wide variety of aircraft, ranging from Piper Cubs to four-engined airliners. It is also licensed to overhaul numerous aircraft engines, of both the piston and jet variety.

The facilities offered include electrical, hydraulic, engine accessory, propeller, instrument, electronics, plating, heat-treatment, plastics, foundry, paint and dope, and carpentry shops. The company has, in fact, achieved virtual self-sufficiency in all matters pertaining to aircraft maintenance and overhaul. Indeed, it claims to be able to meet most foreign competitors on an equal footing—and has made successful bids for highly contested aircraft overhaul and modification contracts from foreign customers.

The extensive production facilities which have been set up and developed have, in turn, created the basis for a programme involving actual manufacturing processes. Starting from the manufacture of parts required for aircraft overhaul and repair purposes, the company has progressed through the building of aircraft ground equipment and supporting systems and culminated in the production of an advanced jet trainer—the Fouga Magister—under licence from Potez Air Fouga.



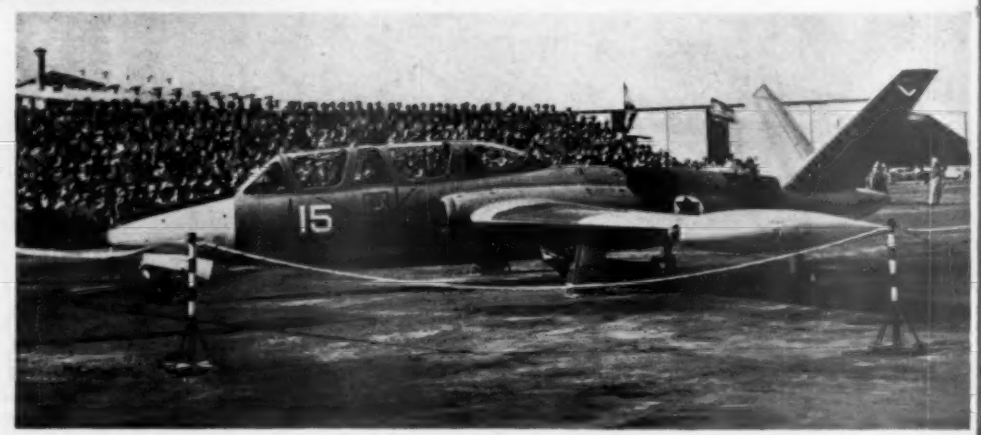
A Douglas DC-4 undergoing overhaul at Israel Aircraft Industries' factory.

Although the French company provides the design and technical data, this is no mere "aircraft assembly" job. Most of the component parts (except for highly specialized systems, such as landing gear and instrumentation) are produced locally and all the tooling employed is likewise a local product. The necessarily reduced scale of production—due to the limited number of aircraft to be produced—has prompted the company to seek "short cuts" and eliminate some of the more expensive tooling items. As a direct result, many of the production methods and sequence had to be extensively reshuffled and simplified. A significant innovation was the adoption of plastic-tooling processes.

While coping with these problems the organization has graduated a sizable "class" of personnel with practical experience in a variety of technological skills—many of them entirely new to Israeli industry. This is, perhaps, the most outstanding achievement of the Fouga Magister project. Availability of a pool of skilled personnel is the *sine qua non* of any solidly based industrial economy. With investment capital available, production facilities can be quickly set up, but there are no short cuts to the acquisition of skilled manpower.

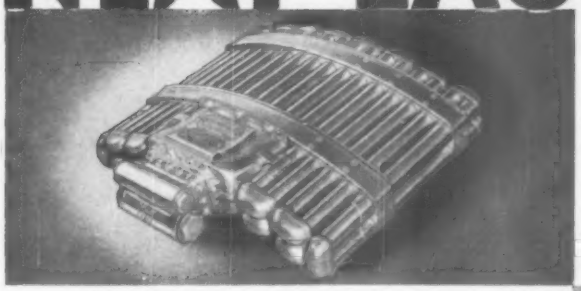
A core of top-notch specialists could be brought from abroad, but the rank-and-file technician—whose skill and experience figure no less prominently in the quality of finished products—must necessarily be "homegrown." With the emergence of this

(Continued on page 165)



Above, installing a main-wheel leg assembly on a Fouga Magister wing. Right, the first Fouga Magister to be built in Israel made its début recently.

HEAT EXCHANGERS



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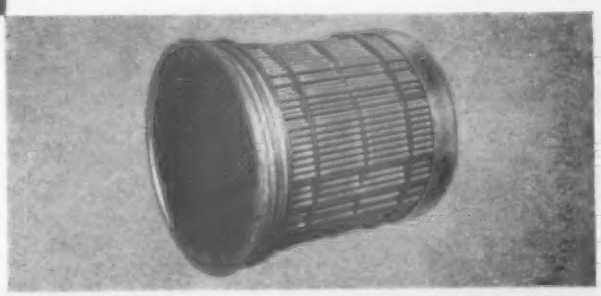
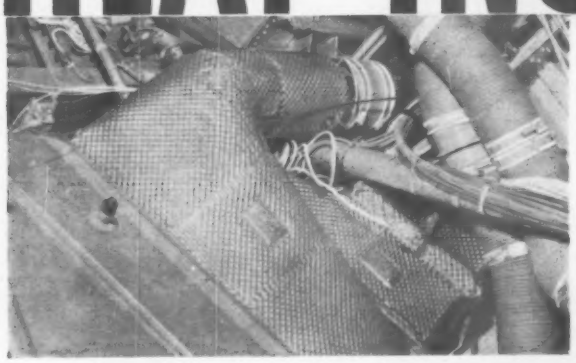


HEAT INSULATION



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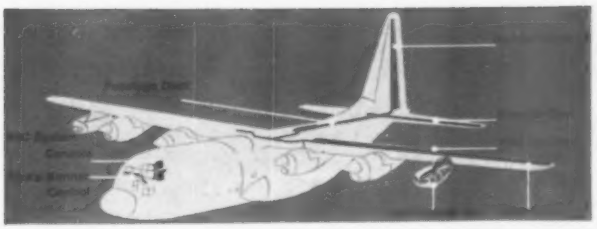
The Lockheed BLC system culminates many years of study by Lockheed engineers and follows four years of research devoted to specific application of the system to the Hercules.

Four auxiliary jet engines, weighing only 500 pounds each, will furnish the streams of high pressure air which flow over all control surfaces. The BLC jet engines are each connected to a central system providing air evenly to all surfaces even with one engine out.

Manufacturing work on the BLC Hercules can begin now because 80% of the airplane is identical to the C-130 B. In Europe, a nation or group of nations could manufacture the C-130 B and have a European version flying in less than half the time required by a new untested design. The program could then be phased into the more advanced BLC Hercules. Know-how acquired by Lockheed in manufacturing nearly 300 C-130s to date can make the BLC Hercules European manufacturing project the most rapid and inexpensive answer to the needs of European nations for a high performance, all-purpose transport.

As a combat transport of men and equipment the C-130 showed its superlative value in airlifts to Lebanon and Turkey.

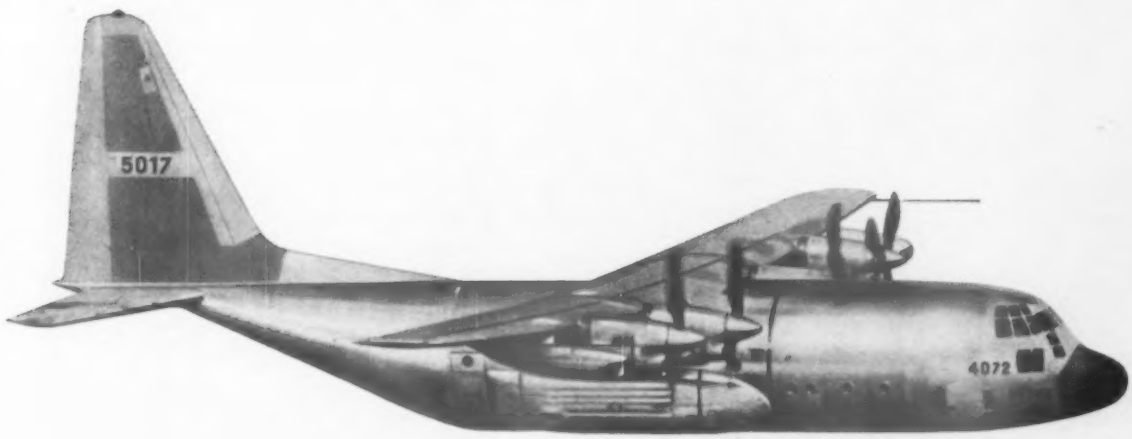


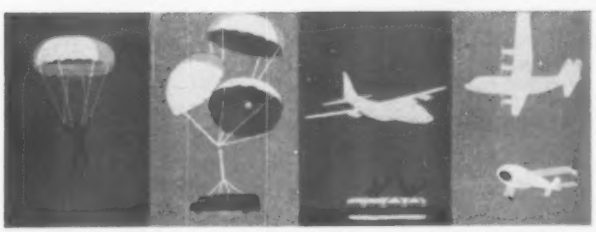
Boundary Layer Control

This illustration shows the Boundary Layer Control system of the Hercules. A pod under each wing carrying two small modified jet engines bleeds air which flows over all control surfaces, ailerons, flaps, rudder and elevator greatly reducing stall speed of the 61-ton transport.

Licensed manufacture

The Hercules is easily adapted to licensed manufacture. Plans for its production in Europe by a nation or nations cooperating with Lockheed have been carefully studied. Results emphasize spectacular saving of both money and time.





Versatility

The excellent range capabilities of the C-130 enable it to perform long search and patrol missions. Moreover, it can be easily adapted to many different mission configurations including Paratroop Drop, Aerial Cargo Delivery, Air Rescue, Drone Launcher / Director Aircraft, Troop Carrier, Air Refueling, Aerial Mapping and Surveying, etc.

Soft Field Take-off and Landing

The unique landing gear design of the C-130 permits it to operate from soft, unprepared fields. High gross-weight landing tests have been made on grass, sand and pierced steel plank. The C-130 is the largest aircraft to be equipped with skis for snow and ice landings.

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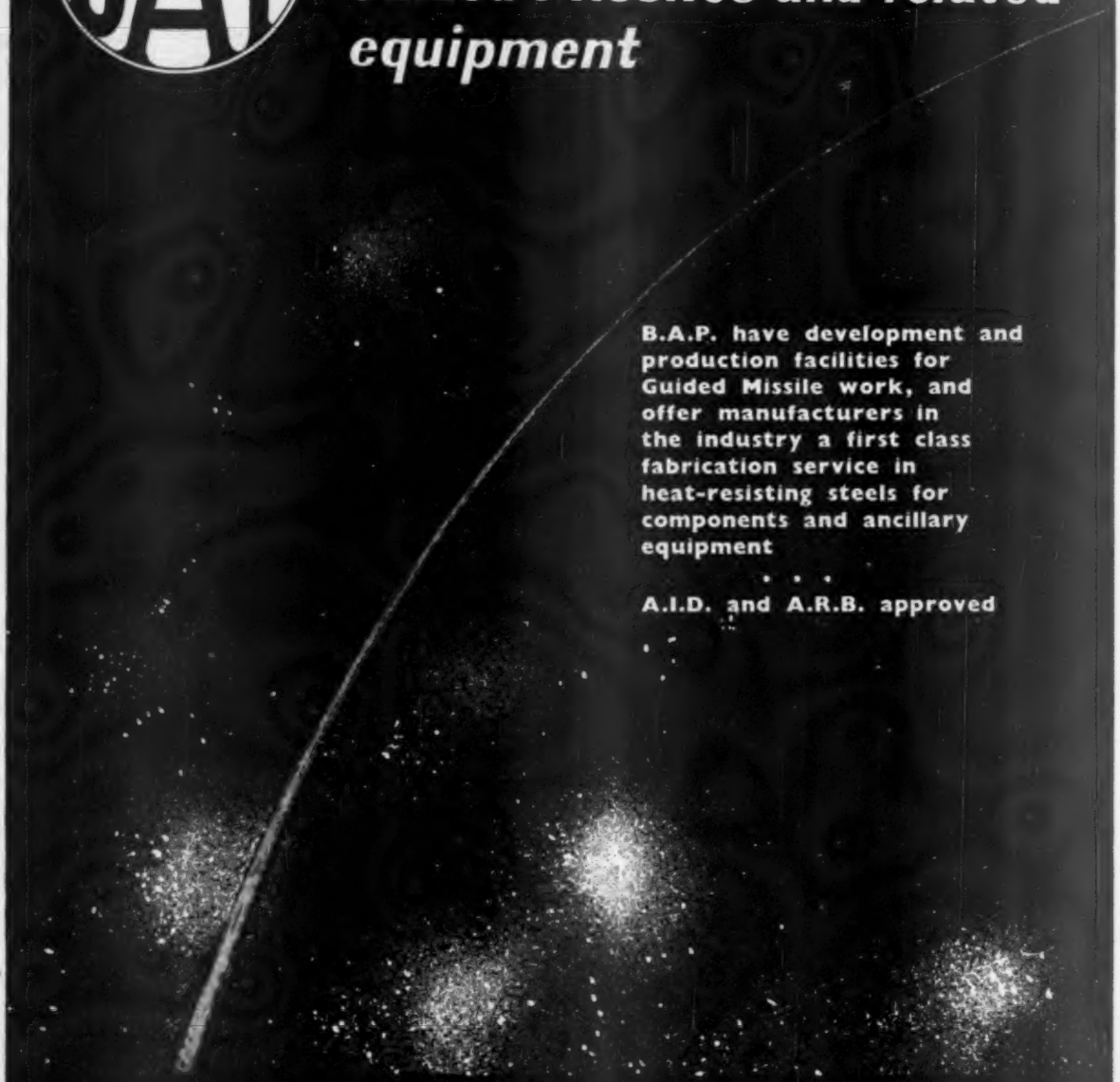

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A view of one of the production hangars of Israel Aircraft Industries, at Tel Aviv.

(*Continued from page 164*)

new class of local skilled technicians, the Israeli aviation industry is able to tread on firm ground.

The company's engineering department has also kept pace with the times. When still in the overhaul and maintenance base stage, Bedek formed an engineering liaison group, to meet shop requirements for rapid engineering decisions to expedite production. Now this group has become the nucleus of an extensive engineering department consisting of specialized design and study groups dealing with aerodynamics, stress analysis, systems design, structural and functional modifications, development of test equipment, materials and process engineering, standardization, etc.

The prime requisites for the independent development and design of modern aircraft are the availability of production facilities, a pool of skilled manpower and an imaginative engineering team. To a large extent Israel Aircraft Industries has now managed to fulfil these requirements. Indeed, the company hopes that with the Fouga Magister project—the first fruits of which are to take the air later this year—it has laid the foundation for the next stage in its evolution—the launching of an independently developed, designed and produced aircraft.

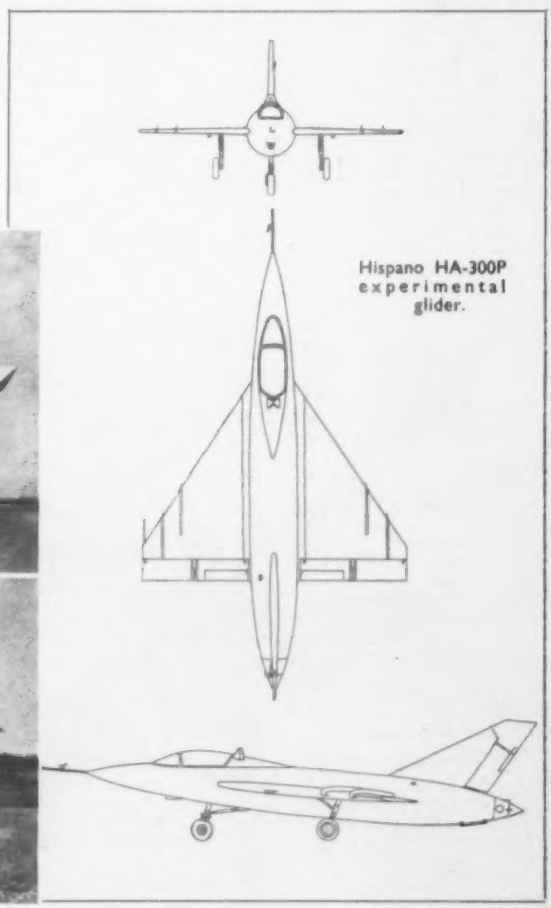
A New Spanish Fighter

A PROTOTYPE of the Hispano HA-300 military aircraft is understood to be nearing completion at Seville; it is to be powered by a Bristol Siddeley Orpheus. The aircraft is apparently a lightweight fighter and ground-attack type. The Hispano team engaged on this project is under the direction of Prof. Dr. Willy Messerschmitt. It is interesting to note that a licence agreement exists between Hispano and the United Arab Republic, according to a Press release issued by Messerschmitt AG of Augsburg. This statement was to deny that Messerschmitt AG was associated with aircraft projects for the U.A.R.

Photographs have been released of the Hispano HA-300P, an experimental glider which probably bears a close resemblance to the HA-300. Towing trials have been made with this glider, initially using a car as the tug and later an aircraft. During these trials the glider took off at 121 m.p.h.; the cable was released between 124 and 155 m.p.h.

Of mixed wood and metal construction, the HA-300P has a clipped-tip delta wing with 57.5° sweepback at the leading edge. Elevon controls are used and two water ballast tanks are installed for trimming purposes. The tricycle undercarriage is non-retractable.

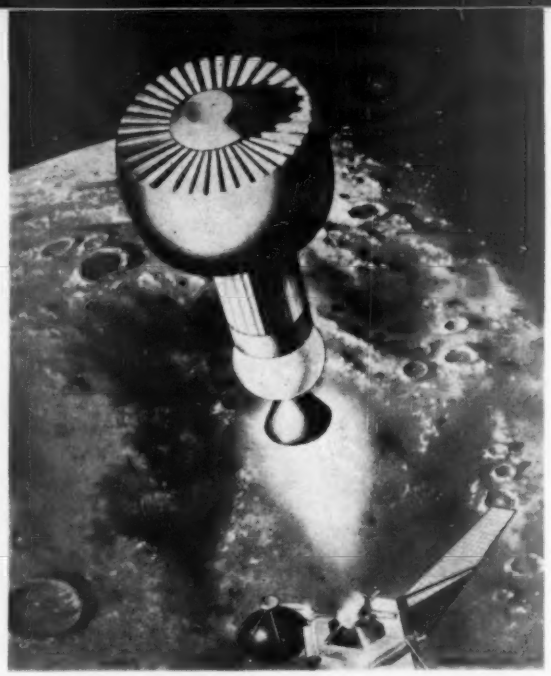
The length of the glider is 33.5 ft., its span 21.6 ft. and its wing area 215 sq. ft. The gross weight is 2,755 lb.



Hispano HA-300P experimental glider.

Project Ranger

Further details of the ingenious American spacecraft designed to deposit instruments on the Moon in working order



Artist's impression of the 300-lb. instrument capsule at the moment of firing the retro-rocket 20 miles above the lunar surface. The parent section of the Ranger spacecraft, from which the capsule has separated, is also seen.

ALTHOUGH one might be excused for thinking that NASA's latest Moon-probe, Ranger, takes its inspiration from Emett, or even Mr. Heath Robinson, it is in fact a most purposeful design and clearly a shape for the future. Preliminary details were given in THE AEROPLANE AND ASTRONAUTICS, May 6, 1960, p. 563, and we are now able to provide more information on its mode of operation, the instruments it will carry, and the proposed test procedures.

Unlike earlier space-probes, Ranger will not be spin-stabilized. It will have full attitude stabilization and ultimately will carry its own propulsion system permitting mid-course and terminal manœuvres.

The first Ranger space-vehicle, 12 ft. long and weighing 700 to 800 lb., now being constructed by the Jet Propulsion Laboratory, is expected to be launched next year by an Atlas Agena B two-stage rocket. Its object will be to test the various interrelated systems and achieve long operating life.

Therefore, the destination of the prototype will not be the Moon and it will not embody the mid-course propulsion system. Instead, the vehicle will be instrumented to obtain comprehensive measurements of radiation in space and other physical properties, such as the influence of the Earth's magnetic field. For these purposes, the spacecraft will be equipped with a magnetometer, an ionization chamber, solar-corpuscular radiation detectors, and a Lyman-alpha telescope intended to look back on the Earth and examine the nature of the hydrogen clouds surrounding it.

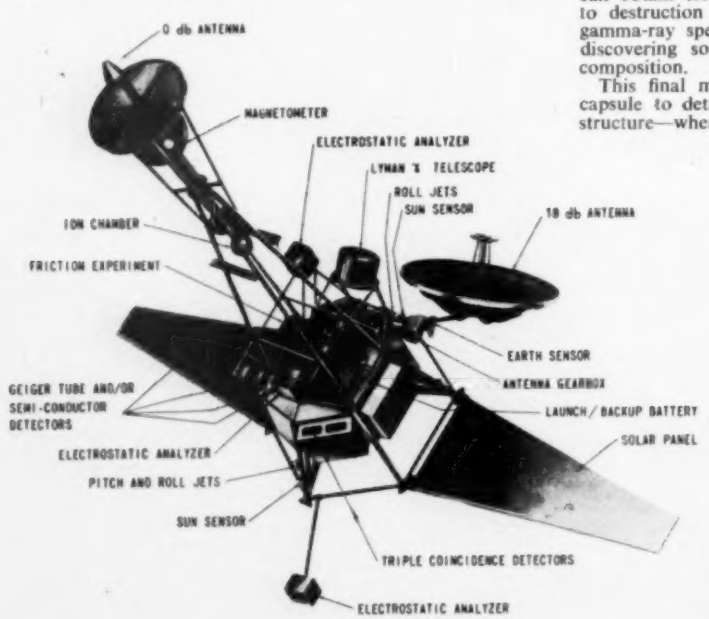
Once operational techniques have been proved in this way, Ranger will be adapted for its principal mission, that of depositing a 300-lb. working capsule of instruments on the surface of the Moon. This survival capsule, now being developed under contract to the Jet Propulsion Laboratory by the Aeronutronic Division of Ford Motor Co., will take the place of the scientific package of the prototype; it will be mounted on the hexagonal platform between the feet of the O db antenna structure. A mid-course propulsion system will also be embodied, complete with the appropriate command receiver and guidance equipment.

The accompanying diagram shows the way in which the Ranger spacecraft will operate. The probe, after leaving the Earth, will orientate itself on two axes so as to collect the maximum amount of sunlight for its solar cells and also to point its directional antenna at the Earth. When the vehicle has travelled a certain predetermined distance, a radio-command signal from Earth will cause it to make a mid-course guidance correction by means of a small rocket which fires long enough to put it on an impact course with the Moon. After this manœuvre has been accomplished, the probe will reorientate itself on two axes to aim at the Sun and Earth once more.

Lunar Impact

Nearing the Moon, about 66 hr. after launching, the probe will perform a further attitude change so that a TV camera can obtain close-up pictures of the Moon as the probe falls to destruction on the lunar surface. During this period, a gamma-ray spectrograph will also be operating as an aid to discovering some of the primary elements of the Moon's composition.

This final manœuvre also allows the 300-lb. instrumented capsule to detach itself—after release of the O db antenna structure—when it is some 20 miles above the lunar surface.



Configuration of the prototype Ranger spacecraft now under construction at the Jet Propulsion Laboratory, CALTEC, in Pasadena.

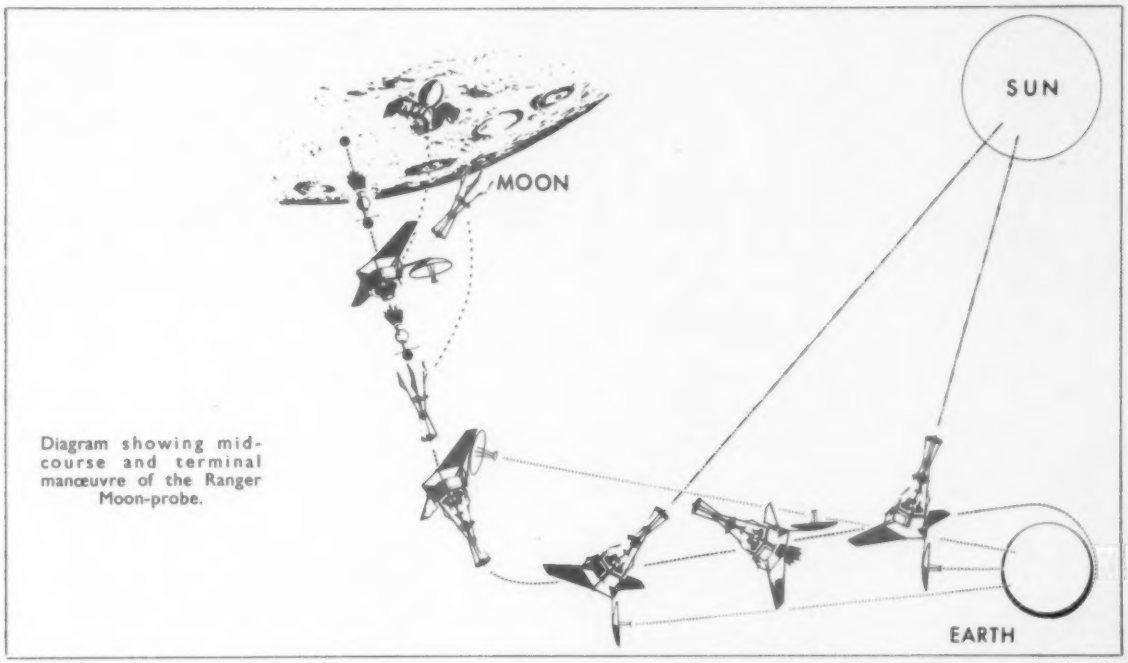


Diagram showing mid-course and terminal manœuvre of the Ranger Moon-probe.

Thus, whereas the parent vehicle will hit the Moon at about 6,500 m.p.h., the separated instrument package will have its speed checked by a braking rocket to fall on to the surface at between 200 and 300 m.p.h. To permit the instruments it contains to survive this impact, which still exceeds 1,000*g*, they will be given the protection of a crushable structure.

Payload of the landing capsule will be an accelerometer to measure the landing impact, a thermometer to determine the local temperature, and a seismometer to record possible Moon-quakes and meteor impacts. Also embodied will be a radio transmitter, batteries and antenna for relaying the results to Earth.

Following the lunar experiment, it is proposed to develop the Ranger vehicles to carry research instruments to the vicinity of Mars and Venus. For this purpose the Atlas-Centaur will be used as a booster.

Kenneth Gatland

Enterprise in Space

BY the spring of 1962, the U.S. Navy expects to have four operational Transit satellites orbiting the Earth which should more than repay the cost of launching them. They will be used for navigational purposes, initially to fix the position of nuclear-powered missile-launching submarines with greater accuracy than can be achieved by more conventional methods. Once the system is working, it is intended to make it available to the World—for the precise navigation of shipping of all kinds.

There is likely to be a big demand for the receiving and computer equipment that ships will need to interpret the satellites' radio signals. The system will be unaffected by weather, and since the intention is to re-broadcast precise orbital data directly from the satellites, there is no question of the VHF signals being affected by disturbances in the ionosphere. A U.S. Navy spokesman in London recently estimated that the cost of the necessary shipboard equipment might be between £2,000 and £15,000, depending on the desired accuracy.

Any financial return the Americans may receive from the marketing of their shipboard equipment will obviously be small in relation to the vast sums they have already invested into space-development, but nevertheless, it is evidence of a trend towards the commercial exploitation of space which may be expected to grow.

In a lecture entitled, "Competitive Private Enterprise in Space,"* Mr. Ralph J. Cordiner, chairman of the board of the General Electric Company, has drawn attention to the opportunities that may exist for private industry.

"As the years pass by and space apparatus becomes more reliable," he says, "and the work of obtaining scientific data from space acquires a more routine character, many of the necessary operating facilities could be put on a self-liquidating, private industry basis.

"Probably the first opportunities for private investment will come in the commercial use of satellites (e.g., a satellite communication system).

"Looking even farther into the future of space exploration, perhaps there would be economic justification for a privately owned launching service that would put objects into space for the peaceful purposes of friendly governments, international agencies, industry and the universities. The private company would put so many pounds of payload into such-and-such an orbit, at an agreed price. At present, the idea has little appeal, since the Government's Scout programme will for a time offer this service free to other nations. But as the number and variety of scientific space launchings increases, and other nations no longer wish to be dependent on the United States Government, the possibility may be worth exploring."

It is not inconceivable that private enterprise will eventually run a global weather information service, based on meteorological information supplied by satellites. We have already had an excellent preview of the way in which meteorological satellites may chart the global weather distribution in the Tiros satellite. Soon, we shall witness the first satellite experiments in long-range radio communications.

At present, the various American communication satellite projects (e.g., Courier, Advent and Decree) are being supported by military research funds†, but the civil National Aeronautics and Space Administration is watching these developments with considerable interest. Indeed, because of this military

* Given at the University of California, Los Angeles, May 4, 1960.

† Apart from project Echo, the 100-ft.-dia. inflatable satellite to be used as a passive reflector for radio signals under a NASA programme.

programme, the United States may be expected to assume a big lead in World communications. When the time comes for NASA or private industry to take over the development for commercial purposes—techniques will be largely proved and reliability of a high order already achieved.

What does all this mean for Britain and our own space-plans? It has been recently suggested, for example, that the Americans may offer Britain and Canada a share in her own space-programme, which implies that we should abandon any thought of developing our own launching vehicles based on Blue Streak. How far this partnership idea might extend is a matter for conjecture. The idea that we might inject into the American programme commercially rewarding projects of our own actually presupposes a great deal. Having invested so much of their own capital in space-technology, and realizing the potential that exists, the Americans are unlikely to hand over, free and for nothing, the opportunity for other nations to become their business competitors.

One can foresee, on the other hand, continuing and fruitful co-operation with the United States on a scientific level, but this is another matter entirely. It was suggested two years ago by B.I.S. officials that the U.K. might well be prepared to work on partnership ventures with the United States, perhaps in the development of specialized types of satellites and space-probes—even complete terminal rocket stages. These comments were favourably recorded in a 1958 report of the U.S. Select Committee on Astronautics and Space Exploration.

Making A Start

A start in the general direction of space-co-operation has been made with the international programme sponsored by NASA, and, as is well known, Britain will provide research instruments for orbiting in the multi-stage Scout vehicle. The first satellite, International I, should be launched late next year. Obviously, this is a form of co-operation that is eminently practicable and will continue to be encouraged by all parties.

This is recognized in the document mentioned above, which concludes: (1) A highly competent, friendly, and critically needed source of scientific manpower is available outside the United States: and (2) some of the most respected and competent scientists abroad are hampered in their work, not only by lack of money and facilities, but also by lack of governmental encouragement.

"If friendly foreign scientists are excluded from the development of astronautics," the report observes, "their individual achievements will be nullified. Without American co-operation, it seems doubtful if Western Europe will be able to launch any space vehicle for some time to come. Conversely, by allowing European scientists to share their know-how with the United States, substantial benefits will accrue to both, and unnecessary expense to the United States may be avoided. . . .

"There appears to be a real desire among key British officials to work co-operatively with the United States and to develop particular British specialities as partnership ventures. It was suggested, for example, that the United Kingdom could build remote-controlled probe vehicles for Moon or Mars shots while the United States continued to develop the main boosters. There is sound basis for co-operative action of this type to the fullest extent possible."

For Britain and her Commonwealth partners, it would be a simple expedient to restrict development to satellites and allow America to launch them. This would mean an immediate saving of some £65 million, since it would no longer be necessary to adapt Blue Streak and Black Knight. We could then also dispense with the extensive range facilities at Woomera which would then revert to a launching ground for short- and medium-range weapons, and upper air-sounding rockets; and we could scrap the engine test-site at Spadeadam in Cumberland. Woomera's contribution to space-development would then be restricted to tracking and communications, a rôle for which it is already being liberally equipped by the Americans. We could, of course, purchase rocket vehicles from the Americans for launching at Woomera, but in the end this would probably be as costly as if we kept on with Blue Streak and Black Knight.

The situation is thus fairly clear. On the one hand, if we contracted out of the launching picture, this would effect an immediate saving of so many millions of pounds in Government expenditure. In return, a few millions might be allocated for satellite development to give the United Kingdom a small holding in space, in conjunction with the Americans.

On the other hand, abandonment of Blue Streak would mean that a large section of a highly skilled industry concerning itself with rocket engines, structures and systems, would be discarded. The large sums already invested in building up this industry under the Blue Streak project would be lost and if, at any time, a change in Government policy decreed that we acquire the ability to launch our own space-vehicles, the cost of re-building our rocket technology would be far greater than the sum we are arguing about today. In this context, we must not overlook the possibility that military space-activities will become important by the end of the decade—indeed probably much sooner!

This leads us to another important question. Quite apart from the issues surrounding "commercial" satellites, what would happen to our political autonomy if America were to launch all our satellites and space-vehicles, and how could we expect to operate our own military satellites—if need be—independently of the United States? In the best of circumstances, we should have to await the convenience of their launching schedules—unless, of course, we leased a portion of American soil as a British launching base!

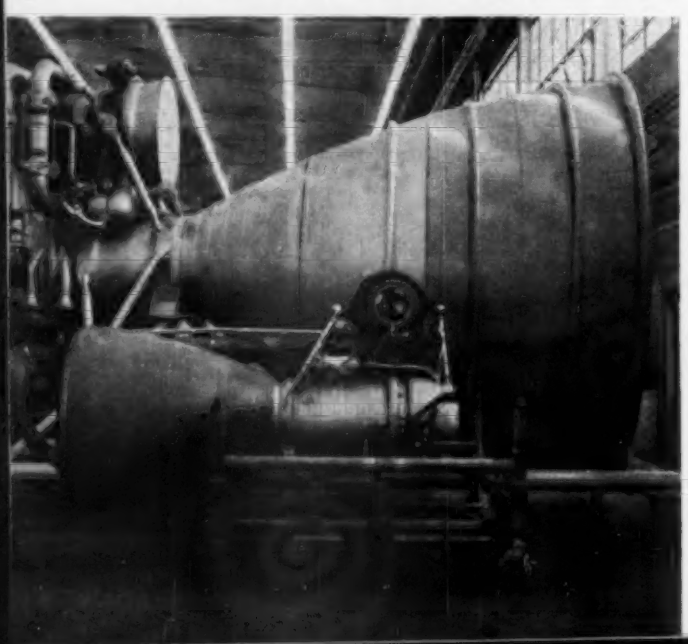
There has been enough fuss made about our reliance upon an American missile, the Skybolt, launched from our own aircraft. How much more anguish would be caused by a future decision to have the Americans launch our every piece of military space-equipment?

A British Launcher

The point even now does not seem to have been taken in some quarters that in Blue Streak and Black Knight we could have a launching vehicle capable of putting between 1,000 and 2,000 lb. into orbit, in perhaps three years. This payload capacity would be perfectly adequate for orbiting useful communications satellites on the lines proposed in the B.I.S. recommendations to the Government (THE AEROPLANE AND ASTRONAUTICS, Jly. 15, 1960, p. 60), and indeed, with the increasing trend towards miniaturization, it is difficult to find any satellite application, short of 24-hr. stationary orbits and manned spaceflight, which could not be satisfied by this vehicle combination. This would include reconnaissance satellites and other applications of military interest.

With Australian co-operation, we might eventually find ourselves in a position to offer the resources of our launching vehicles and the Woomera range—suitably adapted for polar launching—to other nations. Not only would this help to defray the cost but it would give us a position of technical leadership, the benefits of which would certainly extend into political and economic fields. (One has only to realize the extent to which the uncommitted nations of the World have been attracted to Soviet "technical aid," and the products of Soviet industry, by the success of the Sputniks and Luniks!)

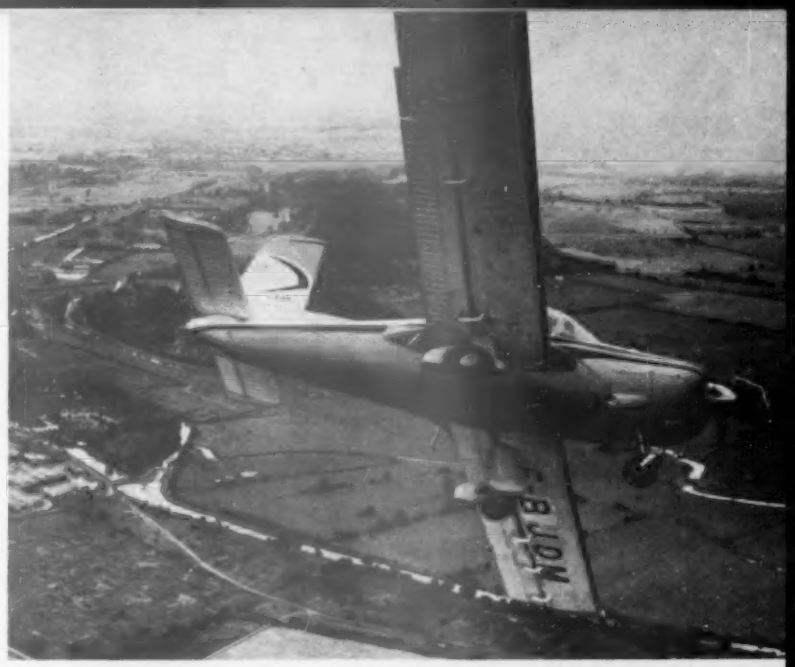
Looking at the whole spectrum of astronautics—and not merely the narrow field of space-research—one feels that the initial sum of £65 million needed to bring Blue Streak and Black Knight to launching status at Woomera would be a small price to pay for all the opportunities it would introduce in the years ahead. Indeed, a decision now against adapting these vehicles, as a short-term financial expediency, could be viewed as a major disaster from the vantage point of the future.



UNCLUSTERED.—A full-scale mock-up of the F-1 1,500,000-lb. s.t. rocket engine which Rocketdyne is developing for NASA, stands behind the H-1 Saturn engine. Thrust produced by clusters of eight Saturn engines equals that of one F-1 which in its turn may be clustered to obtain 6,000,000 to 12,000,000-lb. s.t.

Flying the Morane-Saulnier Rallye

By John Fricker

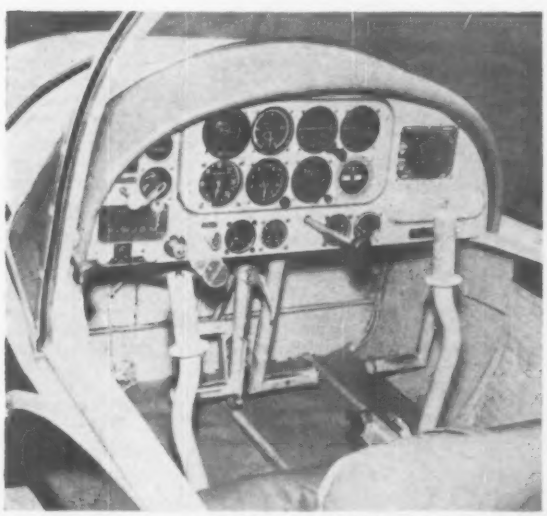


FOLLOWING a recent sales tour of the Continent by the prototype Morane-Saulnier M.S.880 Rallye, F-BJDM, orders for no fewer than 150 production aircraft were obtained from France, plus 35 for export, and 250 have been laid down at Ossun-Tarbes. Apart from its flying qualities, which offer an unusual degree of security, the Rallye appears to have sold on the strength of its robust all-metal construction, and the low price demanded by its manufacturers.

During the recent brief visit by the prototype to this country organized by Mr. J. N. Somers, a delivered price in the region of £2,800, duty paid, was being quoted for this three-seater tourer and trainer, which is powered by a 90-b.h.p. Continental C-90 engine. This price has been made possible by the simple airframe design to mass-production standards, with extensive use of sheet-metal pressings and spot welding in the construction. Although initial tooling expenses are higher with this system, large-scale production has achieved low unit costs.

With its assembly-line production time of 300-350 man-hours per aircraft, the Rallye is approaching the very low figures achieved by American light aircraft manufacturers. The single-engined fixed-undercarriage Cessna range, for example, are believed to require only about 270 man-hours per aircraft for assembly. The concessions to ease of production are, perhaps, more apparent in the angular Rallye, which carries this principle to such extremes as the open U-section trailing-edges on all its control surfaces and flaps, but the use of corrugated skin on these structures to reduce the need for internal stiffeners is similar.

According to the Morane-Saulnier representative accompanying the Rallye on its U.K. tour, the thick trailing-edge sections also give a bonus in control sensitivity at all airspeeds. They certainly make it a simple matter to hang trim and balance tabs directly on the rear of the control surfaces with piano hinges. Elevator trim is achieved in this manner, with a notched " cheese-cutter " type selector lever between the two front seats.



Photographs copyright "The Aeroplane and Astronautics"

Layout of the Rallye cockpit is pleasant and reasonably spacious, and the aircraft is quite well equipped. An Airstal 20-channel VHF radio is fitted on the starboard panel.

The aileron tabs serve as balance units and decrease lateral stick forces.

They are uncommon on so light an aircraft, but are probably necessitated by the unusual aileron design. The Rallye has a high-lift wing with full-span automatic slats, and wide-span slotted area-increasing flaps; in consequence, the slotted ailerons are short in length, but extend to about 40% of the mainplane chord. The Rallye has an uncommon amount of gadgetry for a light aeroplane, and it was interesting to compare its low-speed handling and performance with its uncomplicated compatriot, the Jodel Mousquetaire, which I flew and described last week.

With full flap, the Jodel waffled in and out of the stall at about 50 km./hr. (31 m.p.h.) I.A.S., but with power off in a similar configuration the Rallye would not stall or fly below a minimum airspeed of 75 km./hr. (47 m.p.h.). With the stick on its aft stop and slats fully extended it simply descends in a nose-high attitude under full control at about 880 ft./min., in a parachute-like approach. The rate of sink, of course, can be regulated with the throttle to any desired figure within fine limits, and for practical purposes it can be said that the Rallye stalls not, power on or power off, neither does it spin.

In this respect, as in its appearance at some angles, the M.S.880 reminded me of the little Ercoupe, which achieved a similar effect by restricted elevator travel. Although more conventional in its controls than the Ercoupe, the Rallye would still appear to be unrepresentative in its low-speed handling for use as a trainer, but it has apparently been ordered by many French flying clubs for that purpose. It is well equipped for training, however, with central and left-hand throttle plungers (rather stiff in the prototype), as well as full dual controls, except for toe brakes fitted to the port rudder pedals only.

Each toe brake may be individually locked by a lever on its rudder pedal tube, and released by a quick jab of the foot. Taxi-ing is controlled by differential braking; the nosewheel castors but does not steer. For a small aeroplane the Rallye is well instrumented, although the gyro horizon and D.I. in the prototype are non-standard extras. A small disc below the port dashboard is an on-off fuel cock for the wing leading-edge fuel tanks, which in the prototype have a capacity of 24 gal. The gauge comprises a glass tube in the starboard cockpit wall, where it is not easily visible to the pilot when the right-hand seat is occupied.

With this fuel load it is possible to carry three adults in the Rallye, with 13 lb. available for hand baggage, and there is enough room on the rear bench seat for two large children, as an alternative. Production aircraft are to have a 17-cm. (6¾-in.) extension in the rear cabin for extra leg-room, and will have a 4-cm. (1½-in.) increase in cockpit width following relocation of the central flap and trimmer controls. They will also have 7 cm. (2¾ in.) more leg-room towards the front bulkhead.

The M.S.880 will be offered in basic form with either the 90- or 100-b.h.p. Continental, depending on availability of the former engine, and there will also be a Super Rallye, powered by a 145-b.h.p. Continental O-320-A flat-six power-plant. Although remaining a three-seater, the Super Rallye will have additional wing tankage bringing its fuel capacity to 37.4 Imp. gal., which is also available in the lower-powered versions. Plans are in hand for developments with even more powerful engines, beginning with the 160-b.h.p. Continental and

extending to 200 b.h.p., and a full four-seat cabin capacity.

In its prototype form, the Rallye is cleared for aerobatics only when flown solo, when it is stressed to 9*g*, but production aircraft will have dual aerobatic capability. It was therefore not possible for me to sample this aspect of the M.S.880 when I flew several trips with test pilot M. Leboucher, although he had shown some neat rolls at Panshanger.

The Rallye has the usual French-pattern aerobatic harness on the front seats, with five-point attachment to the quick-release box, but only the lower half was used, as a lap-strap. Cabin entry was not difficult, via a fixed step and a small wing walkway forward of the very large fillet, and the big bubble canopy slid right back like that of the Rallye's jet elder brother, the Paris. Morane-Saulnier appear to have borrowed liberally from their Paris for many fuselage details and the high-lift wing owes much to the turboprop M.S.1500 Epervier ground-attack prototype.

All-round view from the Rallye is nothing less than superb, and the substantial crash-arch formed by the windscreen rear frame is reassuring. Neither rudder pedals nor seats in the prototype are adjustable, but I found the control layout and accommodation comfortable. Engine starting is by means of a lever hinging sideways from under the instrument panel, where it is out of harm's way, and the noise level in the cockpit seemed agreeably low.

The levered-suspension mainwheels give a well-cushioned ride on rough grass, and the effective toe brakes permit the Rallye to be turned almost in its own length. As a personal preference I would like to see some degree of nosewheel steering introduced, to save wear and tear and dependence on the brakes. An interesting point about the M.S.880 is that if you do not like nosewheel undercarriages, the mainwheel legs can be moved forward and the aircraft converted to a tailwheel layout in less than half an hour.

In the prototype, ground clearance of the rear fuselage is very small, and during take-off from grass the tail bumper usually appears to drag. This is less apparent from the cockpit, but production aircraft will have a raised rear fuselage, as well as a swept fin for styling purposes. Ground contact does not appear to affect the take-off run, which is done without flap at full throttle of 95 Pièzes (that French pressure again*) and 2,700 r.p.m.

I found a jab of right toe brake necessary to keep absolutely straight on the initial run, but the rudder becomes effective almost immediately to counter the moderate swing to port. Slight aft stick is needed to achieve a decisive unstick at about 70 km./hr. (43.4 m.p.h.), and the climb away then seems very steep at 95-100 km./hr. (59-62 m.p.h.). About 3 m./sec. was indicated on the French V.S.I., and 590 ft./min. would seem about right for our weight on the available 90 b.h.p.

The automatic slats were open for take-off and climb, and appeared to close at about 150 km./hr. (93 m.p.h.) on levelling out for the cruise. Their actuating speed, of course, varies quite a bit with angle of bank and acceleration, etc., and I was intrigued to find that they did not appear to have a lock for aerobatics. Their operation has no noticeable side effects, however, in trim change or anything else, as was apparent during a vigorous demonstration by M. Leboucher.

In elaborate pantomime, he simulated a pupil making tight turns low over some point of interest, and from a low-speed Rate 4 bank suddenly yanked the stick right back at a couple of hundred feet. This brought the slats out with a clonk to clutch the air and keep us flying; it would seem very difficult to get yourself into trouble with the Rallye. It took the most brutal misuse of all the controls with complete equanimity, even during the "parachute" descent and when standing on its tail at cruising power.

When I was able to try it in straight and level flight, we settled down to indicate just under 170 km./hr., or nearly 105 m.p.h. at 82 Pz, and 2,350 r.p.m. Consumption is then less than five gal./hr., and one has some five hours' fuel. The controls were responsive throughout the speed range and were well harmonized up to the cruising condition, but the ailerons tended to heavy up with further increases of speed. Otherwise the Rallye had a typical "Continental" feel, with low stick forces, but allied to unusually positive stability.

With its generous dihedral and sizeable fin area, it showed little inclination to be deflected from its flight path by turbulent air, and yet a rapid rate of roll was available from coarse aileron deflection. The aerobatic potential of the Rallye was similarly indicated by the high never-exceed speed of 250 km./hr. (155 m.p.h.).

Trim changes are small at all times, even with full movement of the big slotted flaps, and one of M. Leboucher's demonstration pieces is the snap lowering and raising of the full 30° of flap with hands and feet off the controls. Pulling up the manual level after a slight struggle with the catch, to dump full flap below the limit speed of 130 km./hr. (80 m.p.h.), simply raises the nose about 10 degrees, and vice versa, with surprisingly little sink in the latter case. A notch or two of trim is very effective at cancelling out the light residual stick load.

I gathered that maximum flap deflection was originally 45 degrees, at which the rate of descent in the "parachute" attitude was in the region of 1,200 ft./min., but this was probably too potent for the average amateur pilot. Certainly the flaps are now deceptively effective, and I found the Rallye unusually easy to sideslip for an even brisker descent.

The possibility of a nose-high approach at minimum airspeed and with full control gives one an extraordinarily wide choice of glide paths, verging on the helicopteral, but the Rallye also responds well to the normal technique. A point to remember is to reduce speed momentarily, after lowering flap, to get the slats out at about 80 km./hr. (50 m.p.h.), which is rather below the normal power-off approach speed of 105 km./hr. (65 m.p.h.). The lack of rear fuselage clearance would seem to prejudice a much slower power-on approach, which the high-lift wing makes possible, but a very short landing can be made from a steep glide without power, the elevator remaining potent for the flare-out.

Details of the Rallye's automatic slats and slotted flaps and ailerons are apparent in this view, which also shows the thick open trailing edge sections. In the air photograph above, the slats are seen extended during the initial climb. The big bubble canopy may be part-opened in flight.

After touch-down at about 42 m.p.h. the Rallye settles almost immediately on to its nosewheel, and the brakes can be leant on to stop in less than 300 ft. There certainly seems to be something in the thick trailing-edge theory for retaining control effectiveness at all airspeeds if the Rallye is any indication, although I was not entirely convinced that the aerodynamic elaboration of the airframe justified itself. The important thing is, however, that the slight complication is not passed on to the customer in the form of a higher price, so that the undoubted additional security which is conferred comes as a most welcome bonus.

Leading Particulars

DIMENSIONS.—Span, 31.4 ft.; length, 22.6 ft.; height, 8.9 ft.; wing area, 132.4 sq. ft.

WEIGHTS.—Empty, 1,003 lb.; three persons, 510 lb.; fuel and oil, 182 lb.; baggage, 13 lb.; max. permissible weight, 1,708 lb.

PERFORMANCE.—Max. speed, 120 m.p.h.; cruising speed, 106 m.p.h.; initial climb, 512 ft./min.; take-off run, on grass, 722 ft.; to 50 ft., 1,050 ft.; landing run, 295 ft.; from 50 ft., 820 ft.; range at max. weight, 500 miles.

* 101.331 Pièzes = 1 atmosphere.

Correspondence

Aircraft—Global Production

IN your issue of Jly. 22 last a correspondent, Mr. N. E. Prissinotti, of Canadair, asks whether there is any information on the total World production of aircraft since the first flight of the Wright brothers.

There are, of course, many difficulties in making global estimates of this kind but I did attempt such an estimate in the Second Cantor Lecture to the Royal Society of Arts in December, 1958. Talking of the 1908-1958 period covered by the lecture, I said:

"A World total of more than £200 thousand million (in 1958 values) has been spent on aviation during this period and it would appear, from such figures as are available, that something over 1½ million aeroplanes have been built. As production articles, these have varied in value from light aeroplanes at a few hundred pounds to large jet bombers and transports each worth several million. The total is made up of about 5,000 before 1914; nearly 200,000 during the 1914/18 War; about the same number between the Wars; nearly 700,000 during the 1939/45 War and getting on towards half a million since. More than a third of the total were manufactured in the United States."

Ruislip, Middx. PETER W. BROOKS.
Technical Assistant to Chairman, B.E.A.

Fokker F-22s at Prestwick

IN connection with the interesting information about the two Fokker F-22 machines given in Mr. Zandvliet's letter in your issue of Jly. 15, it may interest readers to know that both these airliners were in the service of the R.A.F. in 1940 at Prestwick airport in Scotland. They were used for navigation training at the school of the Scottish Aviation Co.

It would be interesting to some of the pupils of that year, to know what happened to the aircraft afterwards.

Lytham St. Annes. R. D. FERGUSON.

[The two Fokker F-22s and a single F-36 were taken over for use as navigation trainers with No. 12 E.F.T.S. at the end of 1939 and operated from Prestwick, where the F-36 was damaged beyond repair in 1940. Both the F-22s went to Abbotsinch in 1942, and one fell into West Lock Tarbert on a training flight from that base. The other survived the War and was used by Scottish Airlines on charter to B.E.A. on the Prestwick-Belfast route until August, 1947. It was finally broken up at Prestwick in 1952.—ED.]

The Jet Fuel Controversy

PERHAPS Mr. McGregor, President of Trans-Canada Airlines, would care to define precisely what are the in-flight conditions under which JP-4 has a "real safety advantage." Also where does he obtain his evidence?

I can only assume that Mr. McGregor is referring to the in-flight tank explosion risk. All current fuels can form explodible mixtures according to the prevailing conditions of fuel temperature and altitude, but basic inflammability data shows that JP-4 presents the most risk of all. This has been confirmed by an American research organization which carried out artificially induced lightning strikes on fuel tanks: explosion was readily produced with JP-4, but not with kerosene or gasoline.

The main advantage of kerosene lies, of course, in its low rate of flame spread following crash-spillage and subsequent ignition.

Harpenden. J. W. RICKARD.

£7,000 for an Aerobatcraft

THE Lockheed International Aerobatic Competition has once more passed by, subsequently proving the lack of a suitable British aircraft to compete with the foreign aircraft taking part.

The British pilot takes his Tiger Moth, Currie Wot or "What have you" and sweats blood flying the aircraft to its limits to receive a "well done, you are improving on last year" type of encouragement, without the faintest hope of winning and only the slightest chance of qualifying for the final.

A quick solution to this problem is already in the wind, giving the British pilot a chance to prove what he believes to be true. This is to buy foreign, possibly a Swiss-built Jungmeister at a cost of about £3,000, and make it available for suitable pilots to fly at a central base in the United Kingdom. Bravo!!!, the British pilots are already doing inverted handsprings in anticipation.

The makers of British aeroplanes, of course, do not come in on this and the full answer is obviously for them to design and build a fully aerobatic aeroplane. An aircraft of between 1,200 and 1,500 lb. with an engine as much over 100 h.p. as weight will allow, an inverted fuel system with no limitations, possibly a biplane to allow short span for high rate of roll, well geared controls with control surfaces adequate in size to give complete control in all planes down to the stall, with particular regard to the forward pitching plane. An aircraft of this type would, as is required, be able to manœuvre at low speed and keep well within a normal flight envelope. Thus stress limits would not have to be high, say $+6g$ to $-3\frac{1}{2}g$ safe limits.

Given an aircraft of this design we will have the foreign competitors where we want them, on equal terms.

An ambitious programme? Yes. Expensive? Yes. But would not a sum of between £6,000 and £7,000 for designing, building, developing and maintaining this required aeroplane, and allowing proven pilots a generous number of hours with it, be worth while if only to gain prestige?

Let us act now and get results next year, not only at Baginton, but in Czechoslovakia at the World Aerobatic Competition.

Bitterne, Southampton. H. R. LANE,
FLT. LT., R.A.F.

Groundabout

No Change

"When I was attached to the Ministry of Supply I soon discovered that they knew nothing about aviation. Now that they call themselves the Ministry of Aviation I realize that they know nothing about supply either."

*

Wreprehensible. One of the best ways of finding out if your column is read is to make a mistake. When I spoke of "Calcutta's Santa Cruz airport" two weeks ago, corrections were quick to arrive. The one I liked best, because it tempered reprimand with flattery, came from Tom Howell:—

"I always look first for the views
your column offers on the news,
How apt the comments which you choose
to praise, encourage and amuse.
Despite this tribute, what's the ruse,
or are you simply lacking clues
In putting Bombay's Santa Cruz
near Calcutta? Some marks you lose.
How Dum-Dum can you get? Excuse
my carping doggerel and abuse—
Correction's too hard to refuse."

*

Spectral Spectrum. My recent note here about the scarlet-smoke-stained Flight Sergeant has reminded Chris Clarkson, Vickers Aircraft rep. in America, of an early R.A.F. Display and one "Girlie" Leech who flew the green smoke Grebe and who burst a container—"He walked around the rest of the day bright green from head to foot, most disturbing to those who lingered at the R.A.F. Tent bar, as he would keep popping up in the twilight and leering over people's shoulders."

*

Entente Cordiale=With the Best Intentions

No. 30 All-Weather Vautour Fighter Squadron, French Air Force, were delighted to know that during their recent visit to England their title of "Escadre de Chasse Tous-Temps" was translated as "All-Time Fighter Squadron."

*

Air to Ground. An R.A.F. Central Flying School "trapper" (i.e., examiner) visited the Army Air Corps Centre to sample some of their low-level Austerical flying, which makes effective use of ground contours and vegetation to hide from the enemy. He was taken in this fashion on a tour of local fields and they duly landed in one. The enthusiastic Army pilot asked the R.A.F. man, "How would you like to go back?" and received the hoarse reply: "Fly."

by Gyrene

Industry Record

Ice Protection for Helicopters

Electrical heater mats for helicopter rotor-blade de-icing are now being produced at the Luton establishment of D. Napier and Son, Ltd. Following a Napier approach to Westland Aircraft, Ltd., and the Admiralty, it was agreed that the company should produce prototype heater mats using the Spraymat system; these will be tested next winter in Canada on a Westland Wessex.

The heater mats have been built on a production basis so that they could be used on all-weather versions of the Wessex with an interchangeable blade system, although the technique can be applied to all helicopters.

Three aircraft sets of equipment are being produced. They include heater mats for main and tail rotor blades and the associated electrical control and distribution equipment. Other mat specimens are being built for fatigue, erosion, thermal-fatigue and heat-transfer tests, which will be made by Westlands.

The mats are prefabricated to avoid unnecessary transport of rotor blades. After construction at Luton they are transported to Yeovil for bonding on to the blades.

Each mat consists of sprayed-metal heating elements sandwiched between layers of resin/glass-cloth laminate. The laminate is symmetrical about the blade leading edge, but the spanwise heating elements extend over about 10% of the chord on the upper surface of the blade and 25% of the chord on the under-surface, which presents a larger ice-catchment area in flight.

Each blade has six spanwise heating elements; these parallel elements are connected at the rotor tip and the return path is via a copper-foil strip on the top surface of the mat. Heating elements can thus be switched on in any sequence to minimize power consumption. The heated region is divided into spanwise rather than chordwise areas to simplify the electrical connection problem.

The heater mats are protected against rain erosion and mechanical damage over the inboard section by a coating of a resin compound heavily impregnated with carborundum. The outboard section is protected by an electro-formed sheath of micrograin nickel, produced by the Metachemical Processes technique.

Weight and balance of the mats are closely controlled. For the main rotor each mat is 22 ft. long and its weight must be kept to 140 oz. ±2 oz. Centre-of-gravity position must be held accurate to within ±0.5 in. spanwise and ±0.05 in. chordwise. Tail-rotor mats are similar in construction to those for the main rotor, but they have only a single heated area. Each weighs 9 oz. ±0.125 oz.

On the main rotor, heating elements on opposite blades are coupled, giving 12 cyclic areas for the four main blades. These are supplied from two phases of a three-phase alternator. The third phase supplies the tail rotor. Total power requirement is approximately 18 kVA. Heating intensity is graded by varying Spraymat thickness; it ranges from 30 watts/in.^{2} at the root to 17½ watts/in.^{2} at the tip.

The two main items of the electrical distribution system are a rotor-head distributor and a cyclic interrupter mounted in the fuselage; they weigh 11 lb. and 8 lb. respectively and are produced under sub-contract by Austin-lite, Ltd., to a Napier design. Production weights for these items are expected to be lower. The weight of the heater mats does not all represent a penalty, as most of it replaces balancing weights which would otherwise be needed in the rotor.

Application of the Spraymat elements of a helicopter-blade de-icing mat.

Aircraft Tyres

A recent publication is a new technical book providing comprehensive data about most of the aircraft tyres in the Firestone range produced in this country. In addition to technical information and illustrations of the various types and sizes manufactured by the Firestone Tyre and Rubber Co., Ltd., it includes notes on the care of aircraft tyres.

Precision Servo Components

Vactric (Control Equipment), Ltd., have published an abridged technical data leaflet on their range of precision servo components. This includes AC and DC servo motors; synchronous motors; AC motor tachogenerators; induction motors; and servo gearheads, many of which have been developed to Ministry of Aviation specifications.

Rotary switches and demonstration servo breadboard components are also included in the publication which is available from the company at Vactric House, 207 Sloane Street, S.W.1.

Aviation Calendar

Aug. 6

London.—Science Museum lecture, "The Story of Flight," by Victor Wall, in the Science Museum, Exhibition Road, S.W.7, at 15.15 hrs.

Aug. 8-11

Seattle, Washington.—Western National Meeting of the American Astronautical Society at the Olympic Hotel.

Aug. 10

London.—M.T.C.A. Near Miss Film, at the Kronfeld Club, Basement, 74 Eccleston Square, S.W.1, at 20.00 hrs.

Aug. 14

Elstree Aerodrome.—Tea Patrol, organized by the Elstree Flying Club.

Aug. 16

London.—Metal Physics Committee of the Institute of Metals lecture, "The Physical Nature of Plastic Flow," by Dr. J. J. Gilman, at the Institute of Metals Headquarters, 17 Belgrave Square, S.W.1, at 18.30 hrs.

Aug. 17

London.—Kronfeld Club talk on the National Gliding Week, at the Basement, 74 Eccleston Square, S.W.1, at 20.00 hrs.

Aug. 20

London.—Science Museum lecture, "The Story of Flight," by Victor Wall, in the Science Museum, Exhibition Road, S.W.7, at 15.15 hrs.

Aug. 27

Luton Airport.—Luton Flying Club Aerial Day, at 15.00 hrs.

Aug. 29

London.—European Congress of Aviation Medicine on "Human Problems of Supersonic and Hypersonic Flight," until Sept. 2.

Sept. 1

London.—Society of Instrument Technology and British Interplanetary Society Symposium on "Rocket and Satellite Instrumentation," at Manson House, 26 Portland Place, W.1.

Company Notices

NEW COMPANIES

World Wide Aviation, Ltd. (664,369).—Private co. Reg. Jly. 6. Cap. £1,000 in £1 shs. Directors: Frank E. S. Seary, The Anchorage, Mount Pleasant, Hartley Wintney, Hants.; William J. Bright, Woodpeckers, Prince Consort Drive, Ascot, Berks. Sec.: F. E. S. Seary. Reg. office: Woodpeckers, Prince Consort Drive, Ascot, Berks.

Central Seaways, Ltd. (664,507).—Private co. Reg. Jly. 7. Cap. £100 in £1 shs. Ship and air brokers, ship and aircraft agents and managers. Sec.: Mrs. Joan D. Oliva. Sols.: Frank Simmonds Parker and Hammond, 177 Salisbury House, E.C.2. Reg. office: 101 Leadenhall Street, London, E.C.3.

Park Air Services, Ltd. (664,661).—Private co. Reg. Jly. 8. Cap. £1,000 in £1 shs. Air freight transport contractors. Directors: Sir Richard Jenks, Bt., 14 Finsbury Circus, E.C.2; Colin Turnbull, 107 Park Road, W.4; Daniel E. Elsey. Sec.: H. J. Payne. Sols.: Ager and Ager, S.W.1. Reg. office: Dominion Works, Thames Road, W.4.

INCREASE OF CAPITAL

K.A.C., Ltd. (368,933).—Electrical, aeronautical and marine engineers, etc., 1-3 Churton Street, S.W.1. Increased on Jan. 23, 1960, by £31,224, in £1 ordinary shares, beyond the registered capital of £30,000.

New Patents

APPLICATIONS ACCEPTED

847,058.—**Brevets Aero-Mecaniques S.A.**—"Rockets and suspending and launching means therefor."—Sept. 10, 1958. (Sept. 28, 1957.)

846,954.—**Bristol Siddeley Engines, Ltd.**—"Exhaust systems for jet propulsion engines."—Nov. 3, 1958. (Nov. 8, 1957.)

847,000.—**M.S.P. (Luxi-Products), Ltd.**—"Kites." Mar. 9, 1959. (Mar. 8, 1958.)

847,521.—**Napier and Son, Ltd., D.**—"Helicopter propulsion systems."—Jne. 3, 1958. (Mar. 4, 1957.)

847,382.—**Transair, Ltd.**—"Douglas DC-3 and like aircraft."—Jne. 18, 1957. (Jne. 21, 1956.)

Printed specifications of the above will be available on Sept. 7, 1960, and the opposition period will expire on Dec. 7, 1960.

847,792.—**Landsman, C.**—"Floors for supporting removable articles in transport vehicles and the like."—Dec. 7, 1956. (Sept. 7, 1955.)

847,616.—**Poult, R.**—"Jet Propelled aircraft."—Dec. 27, 1956. (Dec. 29, 1955.)

848,213.—**Vyzkumny A Zkusebni Letecky Ustav.**—"Arrangement for a cyclic pitch control of rotor of rotorcraft."—Feb. 20, 1957.

847,868.—**Rolls-Royce, Ltd.**—"Vertical take-off aircraft."—Jan. 29, 1959. (Apr. 1, 1958.)

847,684.—**Rotol, Ltd.**—"Undercarriage arrangements for rotary wing aircraft."—Nov. 19, 1958. (Nov. 20, 1957.)

847,926.—**Folland Aircraft, Ltd.**, and **Davies, L. J.**—"Aircraft ejector seats."—Jan. 3, 1958. (Oct. 4, 1956.)

848,208.—**Martin-Baker Aircraft Co.**, and **Martin, J.**—"Means for securing an occupant on a seat such as an aircraft ejection seat." Nov. 12, 1957 (Dec. 21, 1956.)

Printed specifications of the above will be available on Sept. 14, 1960, and the opposition period will expire on Dec. 14, 1960.

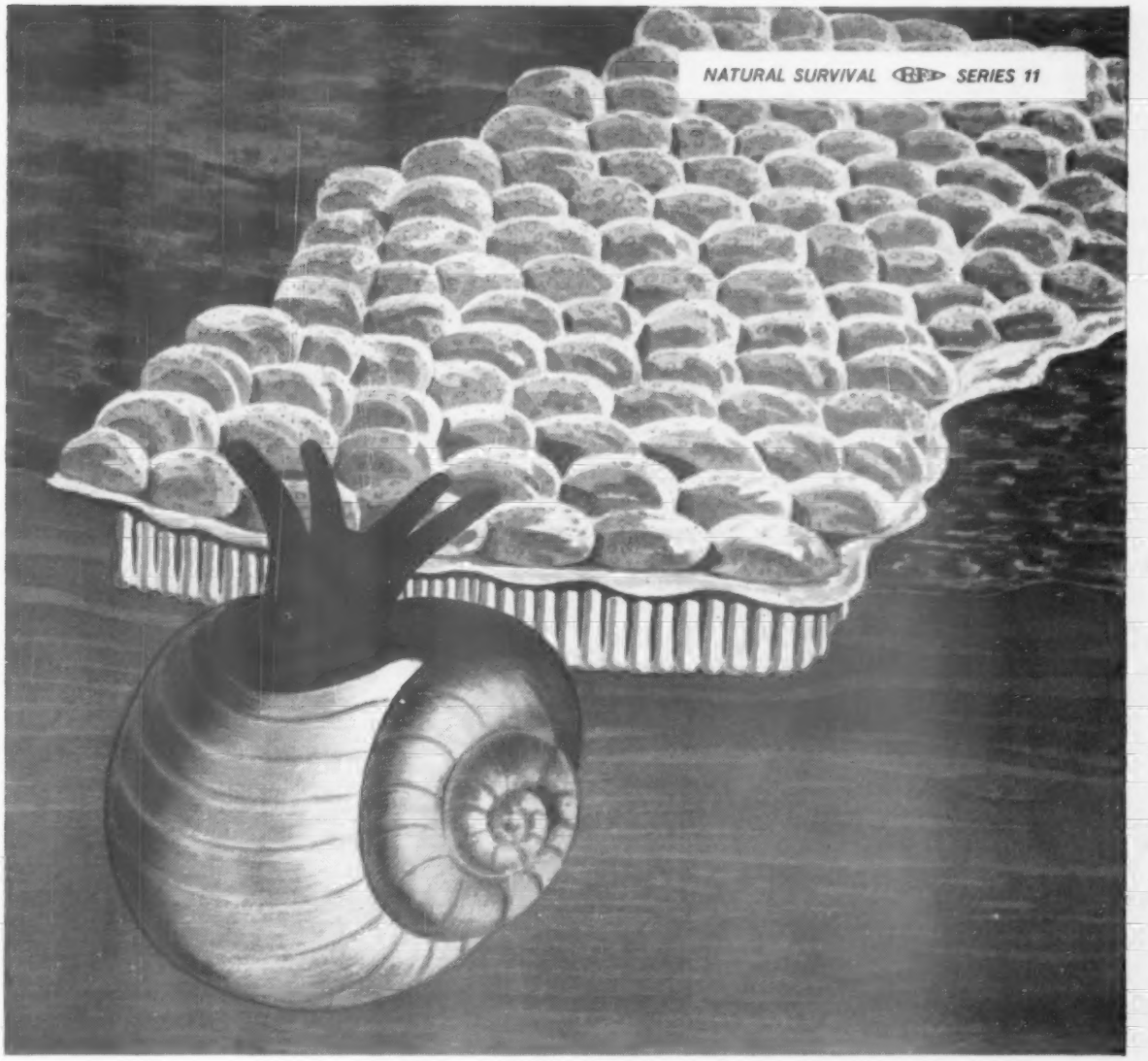
Personal Notices

BIRTHS

Paton.—On Jly. 14, at R.A.F. Hospital, Nocton Hall, to Patricia, wife of Flt. Lt. Allan B. Paton—a son.

Pollock.—On Jly. 19, at R.A.F. Hospital, Cosford, to Betty (*née* Agard), wife of Flg. Off. Neil Pollock—a daughter.

Ringrose.—On Jly. 14, at R.A.F. Hospital, Cosford, to Marian (*née* Smith), wife of Flt. Lt. George Ringrose—a daughter.



Ianthina BLOWS ITS OWN RUBBER DINGHY

Generally sea-snails, being strictly non-swimmers, live on the shore or close-in on the bed of the sea, where life demands the minimum of effort. *Ianthina Janthina*, on the other hand, suffering the adversity of thin shell protection — and even that meagre covering attractively coloured a deep violet-blue — seeks better odds for survival far out in sub-tropical seas. There it drifts safely attached to its own personal liferaft, nibbling occasionally at the polyps of the Velella jellyfish, which is its staple diet. Ianthina provides its own buoyancy chambers, blowing bubbles from a mucus not unlike rubber solution, which hardens on contact with the water. The bubbles are tough and difficult to puncture and will remain intact long after the snail is dead. They are joined to form a raft, which also serves as a floating pram, with eggs attached to the underside.

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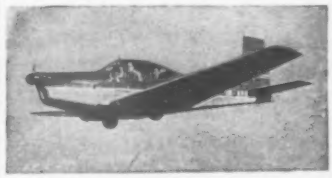

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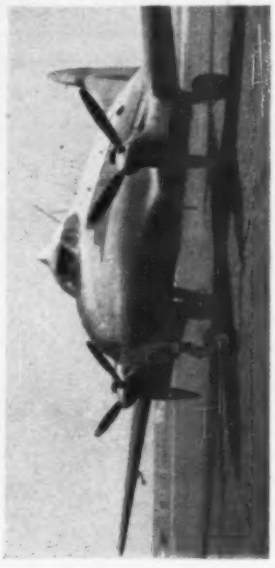

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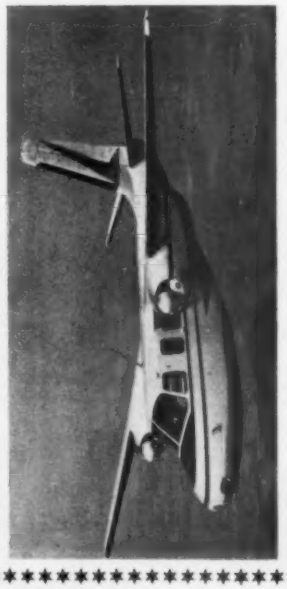

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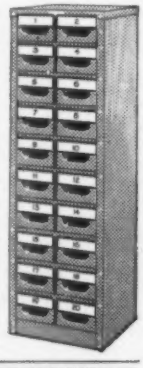

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